SOUTH TIPPERARY COUNTY COUNCIL

DONOHILL LANDFILL SITE

ANNUAL ENVIRONMENTAL REPORT

JANUARY 2009 – DECEMBER 2009

Waste Licence Register No. W0074-02

Prepared by:

South Tipperary County Council
Emmet Street
Clonmel

April 2010

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NON TECHNICAL SUMMARY

This Annual Environmental Report (AER) is required for submission to the Environmental Protection Agency (EPA) in accordance with Condition 11.4 of Waste Licence W0074-02 for Donohill Landfill site. This report presents all the environmental data and other relevant information regarding the operation of the Donohill Landfill Site for the period January 2009 to December 2009.

The site is licensed to accept 40,000 tonnes of waste per annum. In 2009 16,933 tonnes of waste was accepted onsite for landfill, however of this 13,688tonnes was waste and 3,245tonnes was cover material. A further 191 tonnes of recyclable material was accepted at the Civic Amenity Centre, which was taken offsite for recycling.

Extensive environmental monitoring takes place onsite in accordance with the Waste Licence requirements and the monitoring results comprise the main bulk of this report.

Landfill gas (LFG) is produced by the waste as it breaks down. LFG generally consists of 60% methane and 40% carbon dioxide; and it can be explosive when mixed with air in a certain ratio. The LFG produced onsite is collected and flared off at the enclosed 500m^3/hr capacity flare. LFG monitoring includes monitoring of the flare emissions, continuous gas monitoring in the site offices, onsite gas well monitoring and perimeter gas well monitoring. A gas balance calculation shows that approximately one fifth of the gas produced onsite in 2008 was flared, with the rest being emitted directly to atmosphere. In order to improve the gas collection onsite additional gas wells are planned to be drilled in 2010.

The stream which runs adjacent to the site is monitored at 4 locations, two upstream of the site and two downstream of the site. The stream is monitored on a weekly basis for some key parameters; and more in depth analysis of the stream takes place on a quarterly and annual basis. Biological monitoring also takes place in the stream twice a year, where the flora and fauna in the stream are examined. Based on this monitoring data it can be concluded Donohill landfill is not contributing in any material way to the impairment of the surface water quality. A number of groundwater wells are located around the boundary of the site and these are monitored on a quarterly and annual basis.

Rain which comes in contact with the waste becomes contaminated (leachate) and must be collected onsite so that it can be removed for appropriate treatment. There is continuous monitoring of the levels of leachate onsite and the composition of the leachate is monitored on a quarterly and annual basis. An onsite weather station records the rainfall and this data can be used to calculate how much leachate should be produced, which can then be compared with the amount taken offsite.

Other monitoring onsite includes dust deposition monitoring which takes place three times a year and noise emission monitoring and slope stability assessment which takes place annually. The lagoons onsite are also integrity tested every three years.

There were nine incidents reported to the EPA during 2009, some of the leachate related ones were open for a long period of time as heavy rainfall caused consistently high levels of leachate onsite. The incidents can be broken down as follows:

- Seven where leachate trigger level was exceeded
- One where gas migration trigger level was exceeded.
- One where the flare was not running

No complaints were received from members of the public in 2009.

1. INTRODUCTION

This Annual Environmental Report (AER) is required for submission to the Environmental Protection Agency in accordance with Condition 11.4 of Waste Licence W0074–02 for Donohill Landfill Site. This report presents all the environmental data and other relevant information regarding the operation of the Donohill Landfill Site for the period January 2009 to December 2009.

1.1. Scope and Purpose of the Report

South Tipperary County Council holds a waste licence (Register No W0074-02) for the operation of Donohill Landfill Site. The aim of this Annual Environmental Report (AER) is to provide a review of activities at Donohill Landfill Site during 2009.

This is the seventh AER to be submitted under Condition 11.4 of the licence. The Content of this AER is as defined in Schedule G of the waste licence.

1.2. Site Location

Donohill Landfill is located in a rural area, approximately 7km north of Tipperary town and 0.5km south of Donohill. The landfill is comprised of the following areas:

- 21,100m^2 (2.110ha.) capped Area 1 & 2
- 14,800m^2 (1.480ha.) uncapped Area 1
- 6,850m^2 (0.685ha.) uncapped Area 3
- 4,600m^2 (0.464ha.) Area 4
- 7,010m^2 (0.701ha) Roads and office space
- Total area: 54,400m^2 (5.44ha.)

The location of the site is shown on Appendix 1 – Site drawings. The National Grid Reference for the site is 1895E, 1425N.

1.2.1. Site Contacts

1. Site Manager: Ms. Louise Ryan
   Telephone No: (062) 76277
   Fax No: (062) 76277

2. Deputy Site Manager: Mr. Pat Walsh
   Telephone No: (062) 64150
   Fax No: (062) 64157

3. Weighbridge Operator: Mr. Pat Quinn
   Telephone No: (062) 76277
   Fax No: (062) 76277

1.3. Environmental Policy

South Tipperary County Council is committed to conducting all activities such that they have a minimal effect on the environment.

South Tipperary County Councils main objectives are:

1. To comply with the Waste Licence (Licence Reg. W0074-02) and all relevant environmental legislation
2. To ensure that all site infrastructure, as required in Condition 3 of the Waste Licence, is established
3. To ensure that all site personnel are familiar with:

    a. the Conditions of the Waste Licence
    b. the content of the Environmental Management System
    c. all operational procedures

4. To reduce the potential for negative environmental impacts by a programme of continuous development on-site and appropriate mitigation measures.
5. To carry out all environmental monitoring, as required by Condition 8 of the Waste Licence.
6. To provide adequate training and awareness to all employees with regard to minimising environmental risks.

2. WASTE ACTIVITIES

The licensed waste disposal activities of the facility, in accordance with the Third Schedule of the Waste Management Act 1996 are:

Class 1. Deposit on, in or under land (including landfill)

Class 4. Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons

Class 5. Specially engineered landfill, including placement into lined discrete cells which are capped and isolated from one another and the environment

Class 7 Physico-chemical treatment not referred to elsewhere in this Schedule (including evaporation, drying and calcinations) which results in final compounds or mixtures which are disposed of by means of any activity referred to in paragraph 1 to 10 of this Schedule

The licensed waste disposal activities of the facility, in accordance with the Third Schedule of the Waste Management Act 1996 are:

Class 3. Recycling or reclamation of metals and metal compounds

Class 4. Recycling or reclamation of other inorganic materials

Class 9 Use of any waste principally as a fuel or other means to generate energy

Class 13. Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced.

The main activity at the site was the landfilling of non-hazardous domestic, commercial and industrial waste. Schedule A of the waste licence outlines the types and volumes of waste that can be disposed of at the landfill. They are shown in Table 2.1 below.

Table 2.1 Licensed Categories and Quantities of Waste for Disposal

Waste Category	Maximum Quantity (Tonnes per annum)
Household	30,000
Commercial	4,000
Treated Sewage Sludge	500
Construction & Demolition	1,000
Industrial non-hazardous solids	3,500
Treated industrial non-hazardous sludges	1,000
Total	**40,000**

2.1 Waste Quantity and Composition

The quantity of waste landfilled at Donohill is outlined in Table 2.2 below.

Table 2.2 Quantities of waste received at Donohill Landfill

Year	Quantity of Waste (Tonnes)
1989	3,700
1990	3,700
1991	4,200
1992	4,400
1993	7,000
1994	8,000
1995	12,100
1996	13,300
1997	15,700
1998	13,600
1999	40,000
2000	40,000
2001	41,620
2002	36,762
2003	27,512
2004	23,275
2005	20,416
2006	23,724
2007	16,632
2008	17,047
2009	16,933
Total	**389,621**

The quantity of waste recycled during 2009 at Donohill landfill is outlined in Table 2.3 below.

Table 2.3 Quantities of waste recycled at Donohill Landfill

Waste Type	EWC Code	Quantity of Waste 2006 (Tonnes)	Quantity of Waste 2007 (Tonnes)	Quantity of Waste 2008 (Tonnes)	Quantity of Waste 2009 (Tonnes)
Aluminium Cans	15 01 04	00.34	00.20	00.16	00.20
Batteries	16 06 01*	03.59	02.28	02.14	00.06
Fluorescent Tubes	20 01 21*	00.12	00.42	0.44	00.06
Fridges	20 01 23*	26.70	13.68	-	-
Glass	20 01 02	05.92	06.74	09.84	08.96
Metal	20 01 40	60.02	48.34	64.02	41.98
Newsprint	20 01 01	23.40	27.50	37.52	32.40
Oil	13 02 04*	00.90	00.00	00.00	01.12
Steel Food Cans	15 01 04	00.80	01.16	01.14	01.44
WEEE	20 01 35*/ 20 01 36	92.95	76.60	75.54	67.86
Textiles	20 01 10 / 20 01 11	01.04	01.72	02.56	01.96
Dry Recyclables	15 01 06	00.00	04.90	16.64	32.42
Calor Gas Cylinders	15 01 04	00.00	01.58	-	00.64
Household Hazardous Waste	20 01 27*	-	-	-	1.44
	Total	**215.78**	**185.12**	**210**	**190.54**

2.2 Methods of Waste Placement

Waste is deposited within the active area of the site. Any large articles or containers likely to cause a void are crushed prior to deposition. Waste is compacted using a sheep's foot steel wheeled landfill compactor. The compactor passes over the waste a minimum of three times in order to achieve satisfactory compaction.

3. MONITORING AND EMISSIONS

The monitoring carried out during 2009 is detailed below.

3.1. Landfill Gas

All gas monitoring locations are illustrated in Appendix 1 – Site Drawings.

The landfill gas produced onsite is collected and flared off at the enclosed 500m3/hr capacity flare. Annual monitoring of the emissions from the flare was carried out as per Schedule C4 of the Waste Licence. All parameters were within licence Emission Limit Values. The monitoring report on flare emissions can be seen in Appendix 2.

Condition 8 and Schedule D.2 of the licence requires that the licensee conducts the following landfill gas monitoring:

- Monthly monitoring in the gas borehole/vents/wells in order to detect offsite gas migration.
- Weekly monitoring in the site offices to detect accumulation of landfill gas.

Gas monitoring consisted of:

- Monthly monitoring of 15 No. gas migration wells around the perimeter of the landfill
- Monthly monitoring of four gas monitoring wells within the landfill
- Continuous monitoring at the site offices - canteen, manager's office and weighbridge office

3.1.1. Gas Monitoring Results

Gas Monitoring – Site Offices

The system for gas monitoring within the site offices was installed in 2003. This system was operating throughout most of 2008. No gas has been detected at any of the monitoring locations. The gas readings are downloaded from the system and stored in digital format.

The results for the office gas monitoring are presented in Appendix 3.

Gas Monitoring – Perimeter Gas Wells

There are 15 perimeter gas wells around the landfill. Table 3.1 gives the maximum values of CH_4, CO_2 and O_2 recorded during the year at these wells. Methane was below the trigger levels at all of the wells except GM12, which exceeded the trigger level in February. No significant level of methane was detected at any of the adjacent wells. Additional gas extraction wells will be drilled on the site in 2010 in order to help mitigate gas migration. Trigger levels for CO_2 were also breached at GM12 in February.

Table 3.1 Perimeter Gas Well Monitoring Results Maximum Values

Well	Max CH_4 (%)	Max CO_2 (%)	Max O_2 (%)
GM 1	0.2	0.1	20.4
GM 2	0.2	0.6	20.4
GM 3	0.2	0.8	20.7
GM 4	0.2	0.4	20.6
GM 5	0.2	0.4	20.7
GM 6	0.2	0.4	20.5
GM 7	0.2	0.3	20.6
GM 8	0.2	0.3	20.6
GM 9	0.2	0.9	20.5
GM 10	0.2	0.3	20.6
GM 11	0.2	1.3	20.7
GM 12	**1.5**	**2.3**	20.7
GM 13	0.2	0.7	20.4
GM 14	0.2	0.9	20.5
GM15	0.2	0.9	20.4

* The gas is monitored using GA2000 and GFM automatic infrared analysers, which detect levels of carbon dioxide, methane and oxygen. The margin of error of the instruments is plus or minus 0.5%. Therefore readings below 0.5% are insignificant.

Gas Monitoring – Gas Wells within the Landfill

There are four gas monitoring wells within the landfill. Table 3.2 gives the maximum value of CH_4, CO_2 and O_2 measured at these wells.

To manage gas production on site, STCC installed a permanent gas flare in May 2005. The flare is a high temperature enclosed ground flare and its maximum capacity is 500m^3/hour. The monitoring report on the emissions from the enclosed flare during the reporting period is included in Appendix 2.

Table 3.2 Landfill Gas Well Monitoring Results Maximum Values

Well	Max CH_4 (%)	Max CO_2 (%)	Max O_2 (%)
G1	66.4	35.4	16.9
G2	70.5	28.1	20.8
G3	64.7	29.1	14.1
G4	66.4	26.9	19.2

3.2. Surface Water

Condition 8 and Schedule D.5 of the licence require the licensee to conduct weekly, quarterly and annual monitoring on surface water at four monitoring points off site, two upstream and two downstream of the landfill. At the Agency's request an additional monitoring point SW5 (surface water lagoon) is also monitored along with surface water run off points SW7 and SW8 where possible. Trigger levels have been set for each of the parameters specified in the waste licence. Summary data obtained from the a) weekly b) quarterly and c) annual monitoring rounds are presented in Tables 3.3, 3.4 and 3.5 below.

The surface water stream adjacent to the landfill is a small slow flowing stream with extensive siltation \ sedimentation present on the bed throughout much of its length upstream of the landfill site. Downstream of the landfill stream morphology changes and the stream velocity picks up and sedimentation and siltation is not as pronounced. The stream is not used as a drinking water abstraction source. Based on the surface water data gathered for the years 2004 to 2009 it is readily apparent that this stream is suffering moderate pollution upstream of the landfill, which carries through downstream of the landfill facility. The Council has carried out investigations into the causes of poor quality upstream. Based on these investigations it is the Councils belief that the quality upstream is primarily being impaired by agricultural activities both diffuse and point source and this together with the stream morphology is responsible for its current 'Poor ecological Status'. The Councils Environment Section has taken enforcement action against two local landowners. During Council investigations 'Cattle Access' and low summer flows have also been identified as a significant issues *as well as runoff from adjacent bog areas*. Based on the 2009 monitoring data South Tipperary County Council are satisfied that the Donohill Landfill is not contributing in any material way to the impairment of surface water quality. However it is acknowledged that further work is required to improve the quality of this water body. Due to the investment in improvement works at the site the contamination of surface water run-off with leachate has been eliminated. This water continued to be collected in the 'Surface Water Lagoon' during 2009 and was either discharged to the stream as per licence conditions or tankered off site for treatment at Tipperary or Cashel Sewage Plant when the licence conditions could not be met (for example when the assimilative capacity of the stream was too low).

The analytical results are presented below with the raw data attached as Appendix 4.

Table 3.3 Surface Water Weekly Monitoring of Conductivity (µS/cm)

Location	Median	Min	Max
SW1	676	342	770
SW2a	677	329	773
SW3a	674	336	742
SW4	648	367	787
SW5	182	124	355
SW7	293	181	406
SW8	295	173	348

3.2.1. Quarterly Monitoring

Appendix 1 – Site Drawings shows the four surface water monitoring points at Donohill Landfill, as well as the surface water lagoon onsite. The sampling points are located, from upstream to downstream, in the following order: SW4 (next to Ballydonagh Marsh), SW1, SW2a, and SW3a. The surface water lagoon (SW5) was also monitored in 2009 as required.

Table 3.4 Surface Water Quarterly Median Values

Chemical/Parameter	Units	Trigger Level	SW1 Median	SW2a Median	SW3a Median	SW4 Median	SW5 Median
Dissolved Oxygen	mg/l O2	**70**	78.5	80.5	81	79	106
Chloride	mg/l Cl	**30**	13	13.5	13.5	14	5.5
Conductivity	µS/Cm	**900**	589.5	619	594	589.5	180.5
pH	Units	**8.5**	7.7	7.7	7.85	7.65	7.9
Ammonia	mg/l N	**0.75**	0.0965	0.0915	0.085	0.147	0.295
Biochemical Oxygen Demand	mg/l O2	**5**	1.55	1.15	1.45	1.65	5.8
Chemical Oxygen Demand	mg/l O2	**60**	28	20	28.5	17.5	25.5
Suspended Solids	mg/	**20**	6.5	6.5	5.5	6	9

3.2.2. Annual Monitoring

The waste licence requires in Schedule D, that annual monitoring be carried out for those parameters listed in Table 3.5. The data in this table confirms that the Landfill is not impacting on the adjacent surface water body. The parameters covered in the annual programme were below the trigger levels set in each case.

Table 3.5 Annual Surface Water Monitoring Results

PARAMETER	Units	SW1	SW2a	SW3a	SW4	SW5
Temperature	°C	15.9	15.5	15	14.2	20.0
Dissolved Oxygen	% Saturation	76.0	85.0	80.0	78.0	141.0
Ammonia	mg/l N	0.079	0.061	0.053	0.091	0.02
BOD	mg/l O2	1.8	1	1.8	1.5	11.1
COD	mg/l O2	34	8	37	10	42
Suspended Solids	mg/l	13	<10	<6	<6	12
Chloride	mg/l Cl	12	10	11	10	5
Conductivity	µS/cm	550	602	547	514	136
Nitrite	mg/l N	0.013	0.014	0.016	0.02	0.034
o-Phosphate	mg/l P	0.1	0.12	0.092	0.18	0.007
Total Oxidised Nitrogen	mg/l N	0.5	0.6	0.7	0.4	0.3
pH	pH	7.6	7.7	7.9	7.5	7.1
Total Alkalinity (as $CaCO_3$)	mg/l $CaCO_3$	294	327	289	271	65
Aluminium	µg/l	<250	76.8	<250	86.3	231
Antimony	µg/l	<5	18	<5	18.2	5.06
Arsenic	µg/l	<5	6.4	<5	6.4	17
Barium	µg/l	138	196	144	190	97.5
Boron	µg/l	68.3	95.9	67.6	124	62.4
Cadmium	µg/l	<5	7.9	<5	7.9	<5
Calcium	mg/l	93.8	92.5	97.2	84.7	24.2
Cobalt	µg/l	11.9	15.7	11.7	15.8	12.1
Copper	µg/l	<5	10.5	<5	11.3	15.4
Chromium	µg/l	<5	17.9	<5	19.1	<5
Fluoride	mg/l	0.18	0.09	0.18	0.2	0.05
Iron	µg/l	450	486	397	560	<250
Lead	µg/l	<5	4.9	<5	4.9	<5
Magnesium	mg/l	25.6	25.3	25.5	23.5	16.3
Manganese	µg/l	<250	14.7	<250	11.5	<250
Mercury	µg/l	<5	<5	<5	<5	<5
Molybdenum	µg/l	11.9	23.9	12	24	12.5
Nickel	µg/l	6.56	11.7	6.34	12.1	7.08
Potassium	mg/l	14	13.5	13.9	13.9	13.9
Selenium	µg/l	<5	3.5	<5	2.84	<5
Sodium	mg/l	23.4	19.2	22.2	19.2	22.6
Sulphate	mg/l	12	13	13	9.5	7.8
Thallium	µg/l	<5	6.2	<5	6.2	<5
Tin	µg/l	<10	31.5	<10	31.5	<10
Uranium	µg/l	<10	8.7	<5	8.6	<5
Vanadium		<5	21.4	<5	21.6	<5
Zinc	µg/l	<30	43.2	<30	36.7	<30

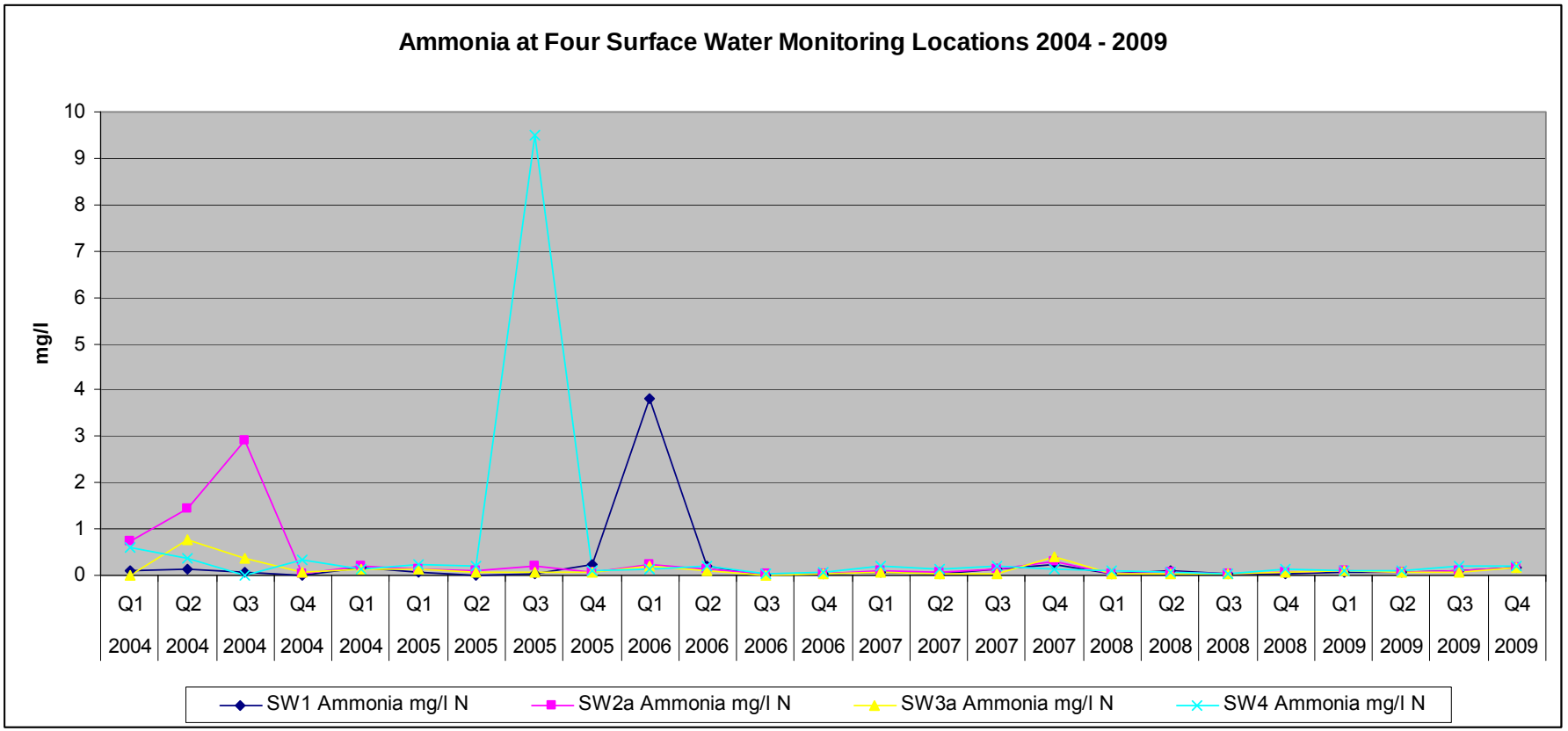


Figure 3.1 Five Year Ammonia Trend (2004 – 2009) at Four Surface Water Locations

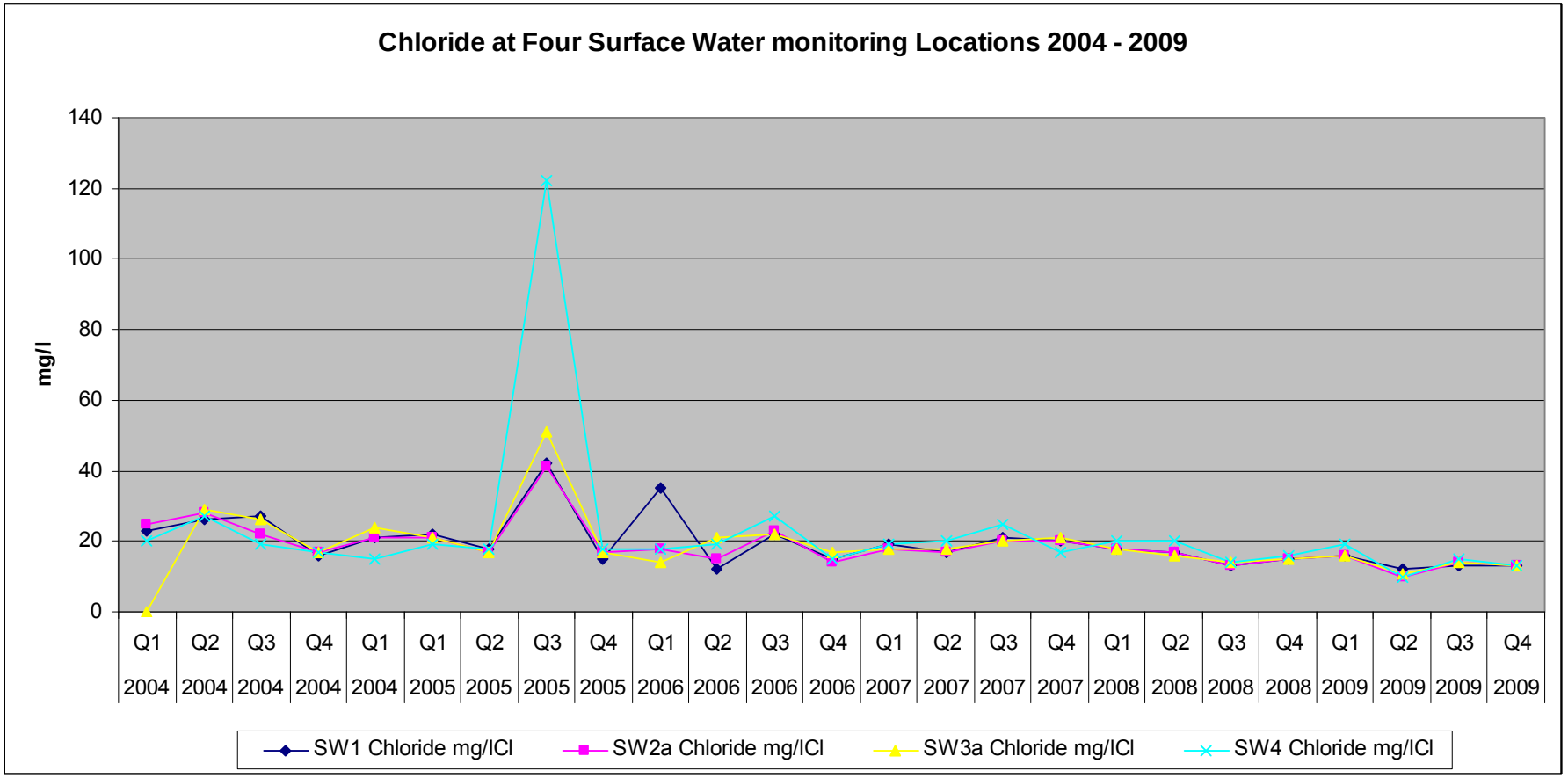


Figure 3.2 Five Year Chloride Trend (2004 – 2009) at Four Surface Water Locations

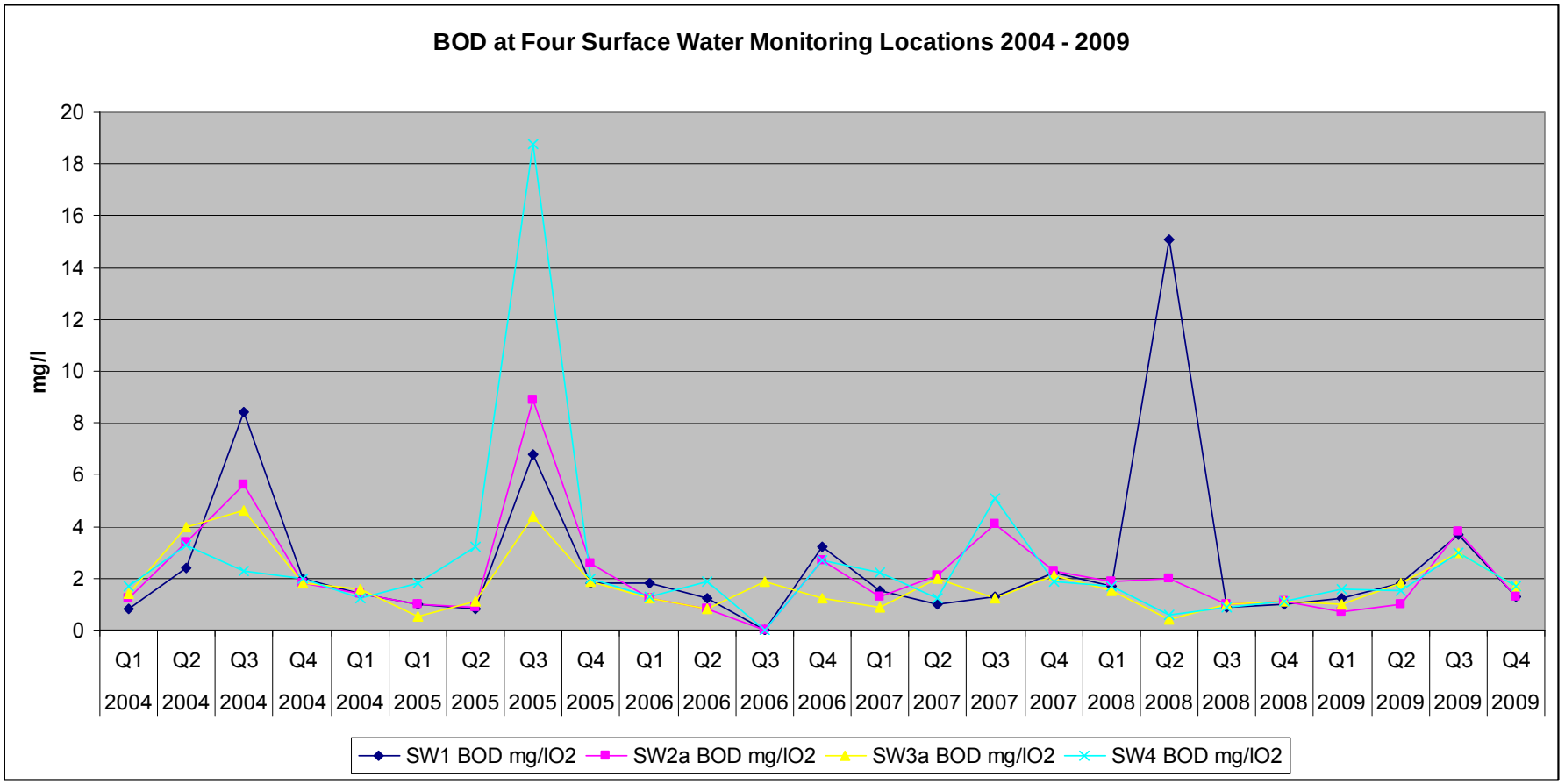


Figure 3.3 Five Year BOD Trend (2004 – 2009) at Four Surface Water Locations

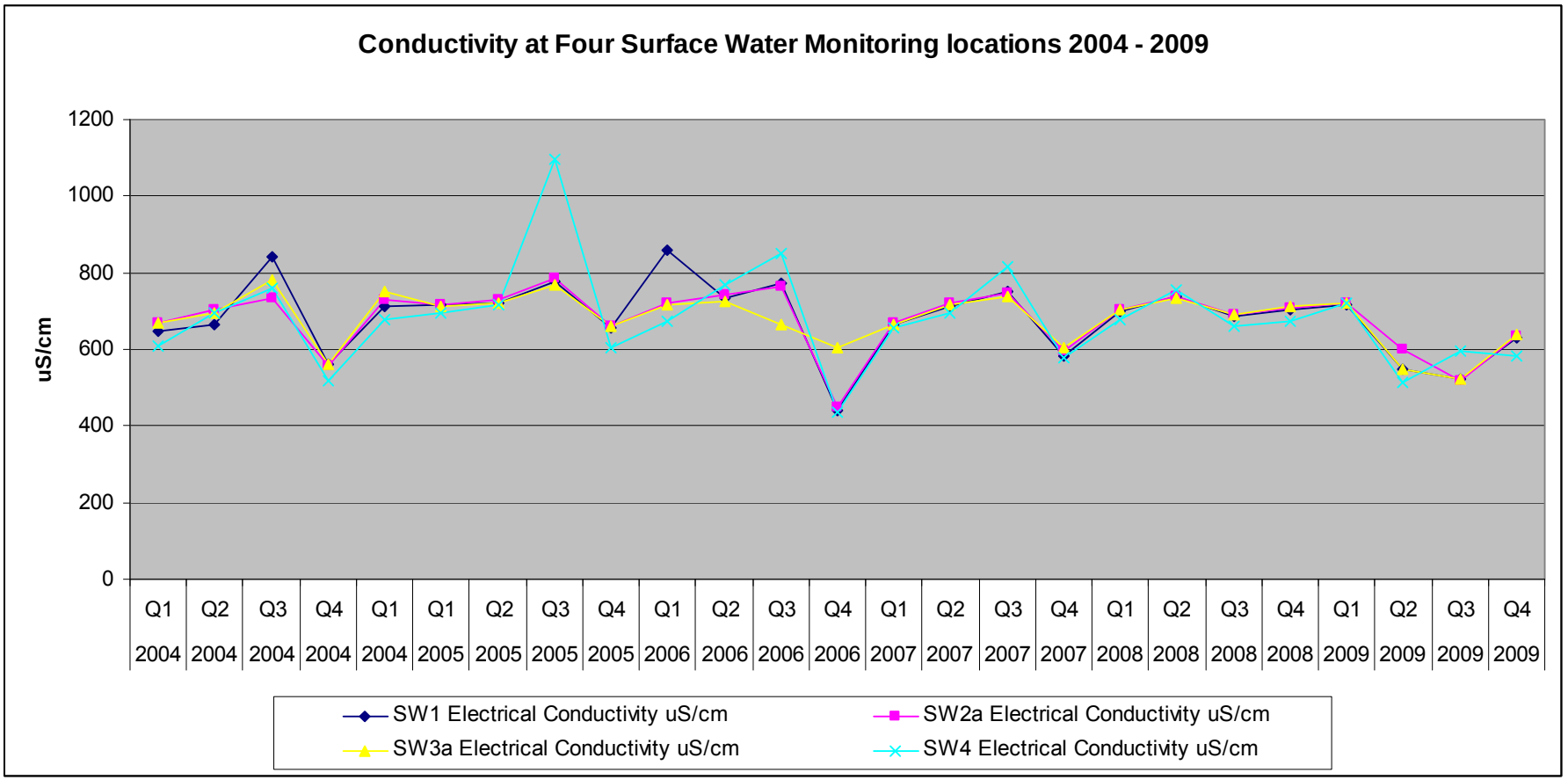


Figure 3.4 Five Year Conductivity Trend (2004 – 2009) at Four Surface Water Locations

3.2.3. Biological Assessment

A biological assessment was carried on two separate dates during 2009 (May and September). The result of this assessment is summarised below in Table 3.6.

Conservation Services carried out the biological assessment on behalf of South Tipperary County Council. There were four sampling points, two of which were upstream of the landfill (SW4 and SW1) and the other two (SW2a and SW3a) downstream. The assessment included flora/fauna populations as well as the physical characteristics of the stream. The biological Q values for each site for the years 2005, 2006, 2007, 2008 and 2009 are presented in table 3.6 below. The assessment indicates that the surface water body is poor at location SW4 and moderately polluted to poor at SW1. SW2a is also moderately polluted. At site SW3a which is downstream of the site, the stream has marginally improved to a moderately polluted condition. The assessment is consistent with the chemical data in that it clearly indicates unsatisfactory conditions upstream of the site. The 'Poor Status' is as indicated in Section 3.2 due to a combination of stream morphology and diffuse & point source agricultural pollution upstream of the site.

The results of the biological assessment contain no evidence that the landfill is causing any deterioration in the biological water quality of the stream. This conclusion is based on the assumption that contamination of stream from the landfill cannot take place either upstream of Site SW1 or downstream of Site SW2A.

Table 3.6 SUMMARY OF MONITORING RESULTS: Q-RATINGS 2005 – 2009

	SITE	Apr 05	Jul 05	Mar 06	Nov 06	Jul 07	Sep 07	May 08	Oct 08	May 09	Sep 09
Upstream of Landfill	**SW4**	1-2	2-3	2	2	2	2	2-3	2	3	1-2
	SW1	2-3	2-3	2-3	2	2-3	2-3	2-3	1-2	2-3	2-3
Downstream of landfill	**SW2A**	2-3	2-3	2-3	2	2-3	2-3	2-3(t)	2	2-3	2-3
	SW3A	2-3	2-3	2-3	2-3	2-3	3	3-4	3	3	3

(t) The Q-rating is tentative as the site was dredged on 20/2/08 and the fauna is likely to reflect this disturbance as well as the water quality.

3.3. Groundwater

Condition 8 and Schedule D of the licence require the licensee to conduct groundwater monitoring at seven groundwater sampling wells, GW11d, GW11s, GW12d, GW12s, GW13, GW14, and GW15. The Well at GW11s is a shallow groundwater well, which runs dry before a sample can be obtained for monitoring. An extra well GW16 (see Appendix 1 – Site Drawings) is a private well off site on a farm near the landfill and has also been monitored. This is a shallow dug well, subject to infiltration with surface water during wet weather and localised contamination from the adjacent farmyard. Condition 8 and Schedule D stipulates that monthly, quarterly and annual monitoring be carried out for groundwater. Summary data obtained from the a) quarterly and b) annual programmes are presented in Tables 3.7 and 3.8 below.

The analytical results are presented below with the raw data attached as Appendix 5.

Groundwater monitoring results have been compared where possible to the Maximum Admissible Concentrations (MAC values) as set out in the Drinking Water Regulations [European Community (Drinking Water) Regulations, 2000 (S.I. No. 439 of 2000)]. None of these wells are used as drinking water abstraction points.

3.3.1 Quarterly Monitoring

The median quarterly monitoring results are shown in Table 3.7. Elevated levels of Coliform Bacteria were recorded in a number of the wells during the year. In Quarter 2 GW12s and GW16 had elevated Total Coliforms; in Quarter 3 GW11d and GW16 had elevated Total Coliforms; and in Quarter 4 GW11d had slightly elevated Total Coliform levels. These occurrences are most likely due to surface water infiltration into the well due to the extremely wet weather. So long as ammonia and chloride levels are normal this is unrelated to landfill activity Sources of Total and Fecal Coliform in groundwater can include:

- Effluent from septic systems or sewage discharges
- Infiltration of domestic or wild animal fecal matter and vegetation
- Wells located in areas that pond or concentrate water on the ground surface

The quarterly groundwater data for the other wells was satisfactory with all parameters well below trigger levels. The data for chloride, ammonia and conductivity in the wells supports the Councils belief that Donohill landfill is not giving rise to any detectable Groundwater contamination.

Table 3.7: Quarterly Groundwater Median Values 2009

Parameter	Units	Trigger Level	GW11d	GW12d	GW12s	GW13	GW14	GW15	GW16
Depth of Borehole	m	-	40	32.5	14.5	31.4	34.25	33	nm
Dissolved Oxygen	% Saturation	-	57	22.5	77	26.5	55.5	33	51.5
Temperature	°C	-	11.3	11.15	10.8	10.95	11.6	11.1	11.35
Chloride	mg/l Cl	**30**	17	23.5	21	15	18.5	19	13.5
Conductivity	µS/cm	**1000**	666	812.5	785	577	600	664.5	764
E Coli	Per 100ml	**100**	10	10	10	10	10	10	15
Iron	µg/l	-	340	225	160	225	320	115	94.5
pH	pH	**8.5**	7.6	7.3	7.3	7.5	7.55	7.45	7
Total Organic Carbon	mg/l C	**5**	0.5	0.5	0.5	0.5	0.5	0.5	1.2
Ammonia	mg/l N	**0.3**	0.08	0.011	0.017	0.093	0.043	0.0585	0.08
Total Oxidised Nitrogen	mg/l N	**5**	2.3	1.6	4.9	0.55	1.4	0.35	4.8
Total coliforms	No/100 ml	**5000**	1000	**12101**	120	10	20.5	10	1005

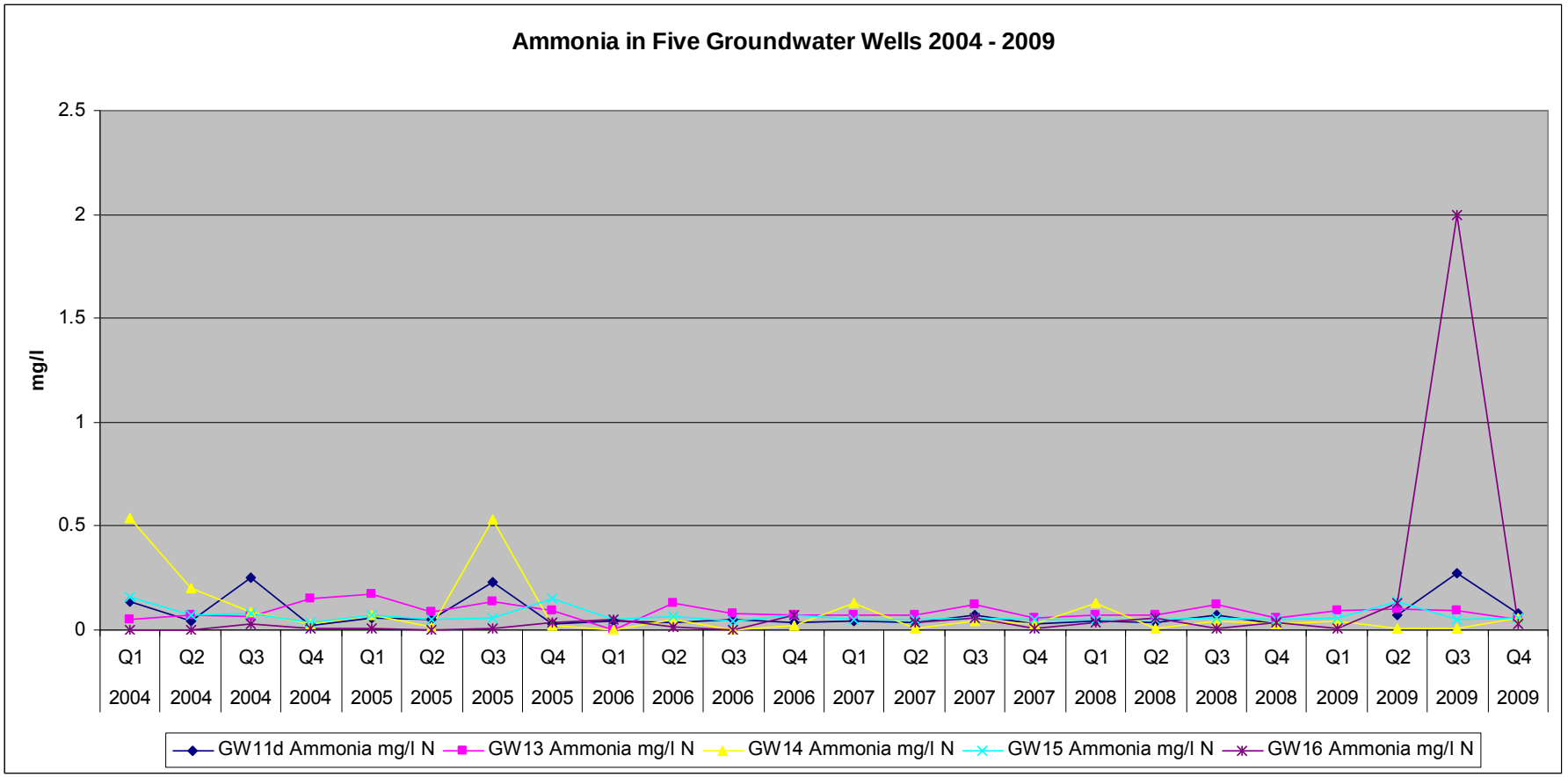


Figure 3.5 Ammonia Trend (2004 – 2009) at Five Ground Water Wells

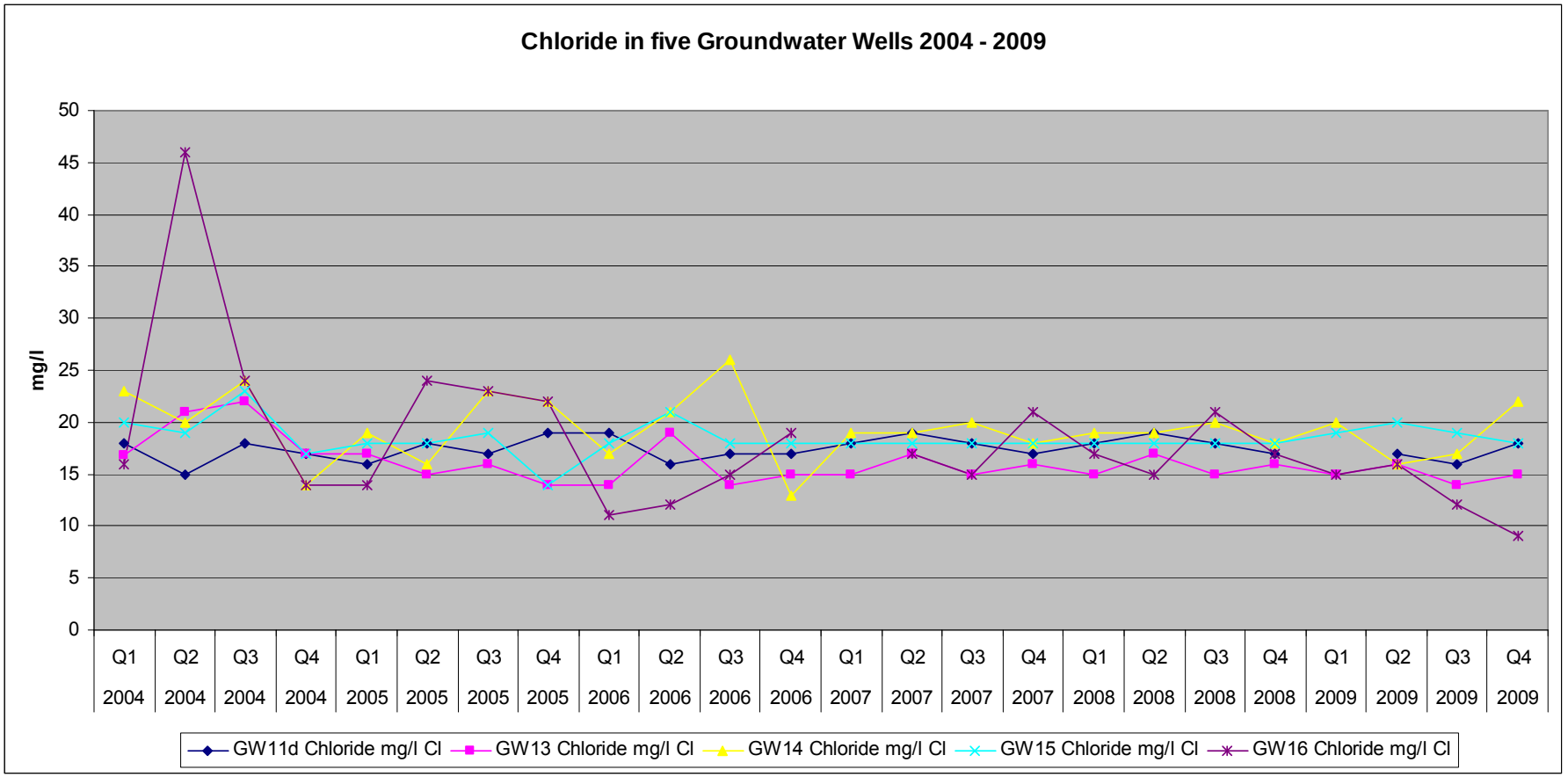


Figure 3.6 Chloride Trend (2004 – 2009) at Five Ground Water Wells

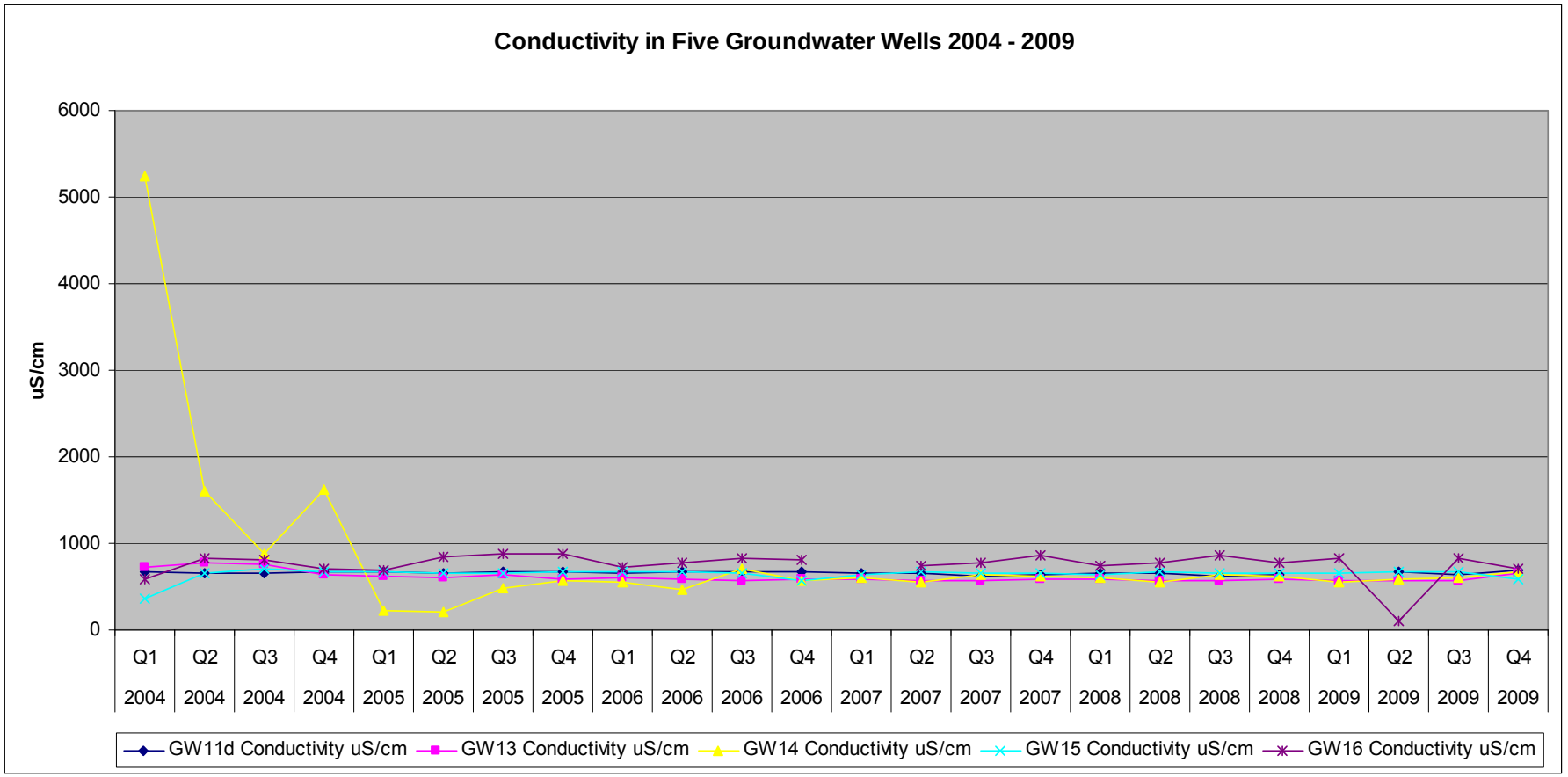


Figure 3.7 Conductivity Trend (2004 – 2009) at Five Ground Water Wells

3.3.1. Annual Monitoring

An annual sampling event was required for those parameters listed in Table 3.8. Table 3.8 outlines those parameters listed in Schedule D and List I/II Organic Substances. The results for parameters covered annually (Presented in table 3.8) were satisfactory for all locations and well below trigger levels set, further supporting the view that no groundwater contamination is taking place.

Table 3.8: Annual Groundwater Monitoring Results 08/07/2009

Parameter	Units	Trigger Level	GW11d	GW12s	GW12d	GW13	GW14	GW15	GW16
Sulphate	mg/l SO4		18	22	33	15	19	28	150
Fluoride	mg/l F		0.23	0.09	0.18	0.16	0.22	0.16	0.74
Calcium	mg/l Ca		75	71	99	54	68	83	150
Magnesium	mg/l	**100**	44	28	35	41	42	35	25
Sodium	mg/l	**50**	31	20	24	32	28	24	26
Potassium	mg/l	**25**	15	13	14	15	14	14	**60**
Aluminium	µg/l		<250	90	170	<250	220	140	<250
Antimony	µg/l		<5	18	18	<5	18	18	<5
Arsenic	µg/l		<5	4.9	5	<5	5.8	5.6	<5
Barium	µg/l		250	280	280	210	270	230	460
Boron	µg/l		150	78	87	94	91	80	77
Cadmium	µg/l		<5	7.9	8	<5	7.9	7.9	<5
Cobalt	µg/l		12	16	16	11	16	16	12
Copper	µg/l		<5	6	8	<5	7	6	<5
Chromium	µg/l		<5	20	22	<5	20	19	<5
Iron	µg/l		<250	160	250	<250	480	150	<250
Lead	µg/l	**15**	<5	5	6.1	<5	**16**	5.8	<5
Manganese	µg/l		<250	<25	110	<250	<25	170	<250
Mercury	µg/l		<5	<5	<5	<5	<5	<5	<5
Molybdenum	µg/l		12	24	24	12	24	25	12
Nickel	µg/l		<5	11	13	<5	11	10	<5
Selenium	µg/l		<5	<0.5	<0.5	<5	<0.5	<0.5	<5
Thallium	µg/l		<5	6.2	6.2	<5	6.2	6.2	<5
Tin			<10	31	31	<10	31	31	<10
Uranium	µg/l		5	8.9	9.6	<5	9.2	9.9	<5
Vanadium	µg/l		<5	21	22	<5	22	22	<5
Zinc		**1**	0.23	<10	<10	<30	<10	<10	<30

Table 3.8 (Continued): Annual Groundwater Monitoring Results 08/07/2009

Parameter	Units	Trigger Level	GW12s	GW12d	GW14	GW15
1,1,1,2-Tetrachlorethane	µg/l	>1	<0.5	<0.5	<0.5	<0.5
1,1,1-Trichloroethane	µg/l	>1	<0.5	<0.5	<0.5	<0.5
1,1,2,2-Tetrachloroethane	µg/l	>1	<1	<1	<1	<1
1,1,2-Trichloroethane	µg/l	>1	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethane	µg/l	>1	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
1,1-Dichloropropene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
1,2,3-Trichlorobenzene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
1,2,3-Trichloropropane	µg/l	>1	<0.6	<0.6	<0.6	<0.6
1,2,4-Trichlorobenzene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
1,2,4-Trimethylbenzene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
1,2-Dibromo-3-Chloropropane	µg/l	>1	<1.3	<1.3	<1.3	<1.3
1,2-Dibromoethane	µg/l	>1	<0.5	<0.5	<0.5	<0.5
1,2-Dichlorobenzene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethane	µg/l	>1	<0.5	<0.5	<0.5	<0.5
1,2-Dichloropropane	µg/l	>1	<0.5	<0.5	<0.5	<0.5
1,3,5-Trimethylbenzene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
1,3-Dichlorobenzene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
1,3-Dichloropropane	µg/l	>1	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
2,2-Dichloropropane	µg/l	>1	<0.5	<0.5	<0.5	<0.5
2-Chlorotoluene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
4-Chlorotoluene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
4-Isopropyltoluene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
Benzene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
Bromobenzene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
Bromochloromethane	µg/l	>1	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	µg/l	>1	<0.5	<0.5	<0.5	<0.5
Bromoform	µg/l	>1	<0.5	<0.5	<0.5	<0.5
Bromomethane	µg/l	>1	<0.5	<0.5	<0.5	<0.5
c-1,2-Dichloroethene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
c-1,3-Dichloropropene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
Carbon Tetrachloride	µg/l	>1	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
Chloroform	µg/l	>1	<0.5	<0.5	<0.5	<0.5

Table 3.8 (Continued): Annual Groundwater Monitoring Results 08/07/2009

Parameter	Units	Trigger Level	GW12s	GW12d	GW14	GW15
Dibromochloromethane	µg/l	>1	<0.5	<0.5	<0.5	<0.5
Dibromomethane		>1	<0.5	<0.5	<0.5	<0.5
Dichlorodifluoromethane			<0.5	<0.5	<0.5	<0.5
Dichloromethane			<0.5	<0.5	<0.5	<0.5
Ethylbenzene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
Hexachlorobutadiene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
Isopropylbenzene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
m,p-Xylene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
Naphthalene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
n-Butylbenzene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
n-Propylbenzene		>1	<0.5	<0.5	<0.5	<0.5
o-Xylene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
sec-Butylbenzene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
Styrene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
t-1,2-Dichloroethene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
t-1,3-Dichloropropene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
tert-Butylbenzene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene			<0.5	<0.5	<0.5	<0.5
Toluene			<0.5	<0.5	<0.5	<0.5
Trichloroethene	µg/l	>1	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	µg/l	>1	<0.6	<0.6	<0.6	<0.6
Vinyl Chloride	µg/l	>1	<0.5	<0.5	<0.5	<0.5

3.4. Leachate

Condition 8 and Schedule D of the licence require the licensee to conduct leachate monitoring at three monitoring points LC1, LE8 and LC4. Quarterly and Annual leachate composition monitoring is required for parameters specified in Schedule D. The analytical results are presented below are for the quarterly and annual monitoring of leachate composition. The leachate monitoring locations are shown in Appendix 1 – Site Drawings.

3.4.1. Quarterly Monitoring

The results for parameters covered in the quarterly monitoring are detailed in Table 3.9, 3.10 and 3.11 below. The leachate composition at Donohill is typical for a municipal landfill site not receiving hazardous waste.

Table 3.9: Quarterly LC1 Leachate Monitoring Results 2009

	Units	LG1	LG1	LG1	LG1
		Q1	Q2	Q3	Q4
Temperature	°C	nsa	22.0	nsa	17.6
Ammonia	mg/l N	nsa	180	nsa	220
BOD	mg/l O2	nsa	24	nsa	20
COD	mg/l O2	nsa	276	nsa	327
Chloride	mg/l Cl	nsa	300	nsa	282
Conductivity	µS/cm	nsa	3930	nsa	4240
Nitrite	mg/l N	nsa	0.013	nsa	nm
o-Phosphate	mg/l P	nsa	1.2	nsa	nm
pH	pH	nsa	7.2	nsa	7.3

Table 3.10: Quarterly LC4 Leachate Monitoring Results 2009

	Units	LC4	LC4	LC4	LC4
		Q1	Q2	Q3	Q4
Temperature	°C	15.2	20.0	18.0	13.3
Ammonia	mg/l N	320	150	160	250
BOD	mg/l O2	284	35	196	35
COD	mg/l O2	911	299	727	492
Chloride	mg/l Cl	592	280	344	347
Conductivity	µS/cm	6340	3560	4200	4870
Nitrite	mg/l N	nm	0.021	nm	nm
o-Phosphate	mg/l P	nm	0.5	nm	nm
pH	pH	7.7	7.6	7.8	7.3

Table 3.11: Quarterly LE8 Leachate Monitoring Results 2009

	Units	LE8	LE8	LE8	LE8
		Q1	Q2	Q3	Q4
Temperature	°C	nsa	29.0	24.0	18.6
Ammonia	mg/l N	nsa	340	0.8	240
BOD	mg/l O2	nsa	680	>300	104
COD	mg/l O2	nsa	1840	1212	595
Chloride	mg/l Cl	nsa	720	435	326
Conductivity	µS/cm	nsa	7410	5310	4650
Nitrite	mg/l N	nsa	0.02	nm	nm
o-Phosphate	mg/l P	nsa	3.2	nm	nm
pH	pH	nsa	7.5	7.5	7.4

nm = parameter not measured
nsa = no sample available

3.4.2. Annual Monitoring

The results of annual monitoring are detailed in Table 3.12 below. The leachate composition confirms that the waste received at Donohill is typical of a municipal landfill and that hazardous waste is not being received in any detectable or significant quantity.

Table 3.12 Annual Leachate Monitoring Results 2009

PARAMETER	Units	LC1	LC4	LE8
Fluoride	mg/l	1.2	1.7	35
Sulphate	mg/l SO_4	110	120	27
Total coliforms	/100ml	>48384	>48384	>48384
Calcium	mg/l	80.8	80.5	132
Magnesium	mg/l	60.9	55.7	116
Sodium	mg/l	242	204	459
Potassium	mg/l	154	148	393
Aluminium	µg/l	162	166	315
Antimony	µg/l	20.8	23.7	33.9
Arsenic	µg/l	49.4	73.7	155
Barium	µg/l	347	327	670
Beryllium	µg/l	7.2	7.2	7.3
Boron	µg/l	2250	1610	1340
Cadmium	µg/l	7.9	8	8.2
Cobalt	µg/l	20.8	22.3	33.3
Copper	µg/l	78.6	92.4	120
Chromium	µg/l	54.9	38.5	84
Iron	µg/l	1880	1820	3230
Lead	µg/l	7.7	7.9	26.5
Manganese	µg/l	1140	693	1190
Mercury	µg/l	<5	<5	<5
Molybdenum	µg/l	24.5	24.6	25.3
Nickel	µg/l	42.8	42.8	93.2
Selenium	µg/l	0.471	0.1	9.9
Thallium	µg/l	6.2	6.3	6.4
Tin		33	32.5	33.7
Uranium	µg/l	10.7	9.8	9.3
Vanadium	µg/l	29.4	27.8	44.7
Zinc	µg/l	31.5	27	77.1

3.4.3. Water Balance

Rainfall data and evapotranspiration figures for the reporting period were obtained from the weather station located on the Donohill site.

The monthly rainfall data is detailed in Table 3.13 below.

Table 3.13 Donohill Rainfall Data

Month	Precipitation(mm)
Jan-09	123.6
Feb-09	14.2
Mar-09	45.2
Apr-09	72.2
May-09	80.2
Jun-09	71.4
Jul-09	128.7
Aug-09	95.6
Sep-09	39.4
Oct-09	123.2
Nov-09	229.4
Dec-09	50.6
Total	**1073.7**

The fraction of effective rainfall estimated to infiltrate into the ground is represented by the infiltration coefficient. For the purposes of this water balance, a number of infiltration values were used. 5% on the engineered cap, 100% on the uncapped and partially capped areas and 65% in temporarily capped areas. It should be noted that these are estimates only, and actual values will vary locally. Table 3.14 represents a summary of the monthly water balance for the site in 2009 Water balance calculations are provided in full in Appendix 6.

Table 3.14 Water Balance Summary

Month	Rainfall (mm)	Total Predicated Leachate (m^3)	Actual leachate tankered off site (m^3)
Jan-09	123.6	3,142.5	2,189.07
Feb-09	14.2	704.1	2,802.40
Mar-09	45.2	1,410.3	1,560.96
Apr-09	72.2	1,958.1	1,127.36
May-09	80.2	2,192.1	1,580.66
Jun-09	71.4	1,862.3	1,787.28
Jul-09	128.7	2,992.8	2,377.72
Aug-09	95.6	2,354.0	1,221.88
Sep-09	39.4	1,181.1	1,801.02
Oct-09	123.2	2,899.4	2,149.54
Nov-09	229.4	4,996.6	3,681.20
Dec-09	50.6	1,423.7	2,520.60
Total	**1,073.7**	**27,117**	**24,799.69**

3.5. Leachate Volumes

The estimated volumes of leachate produced at Donohill Landfill, for the reporting period, are outlined in Table 3.14. The estimated prediction for the volume of leachate to be produced was 27,117m^3. The volume of leachate actually tankered off-site during the reporting period was 24,799.69m^3. The difference in actual and predicted leachate removed from the site may be attributed to leachate that was attenuated in the cells and stored in the lagoon; also the amount of water coming from underneath Area 4 is probably reducing now.

3.6. Dust Monitoring

Under Schedule D of the licence Donohill landfill is required to carry out dust monitoring at three stations on site: ST1, ST2, & ST3 as per Appendix 1 – Site Drawings. Dust monitoring was carried out during the following periods

14th April – 20th May 2009.
22nd May – 23rd June 2009.
02nd July – 06th August 2009.

Dust levels on site were below limit value of 350 mg/m^2/day at each of the monitoring stations during each monitoring period. Results are shown in Table 3.15.

Table 3.15 Dust Monitoring Results 2009

Dust Monitoring Point	Emission Limit	14/04/2009 to 20/05/2009	22/05/2009 to 23/06/2009	02/07/2009 to 06/08/2008	Median
D1 (mg/m2/day)	350	48	83	83	83
D2 (mg/m2/day)	350	25	15	46	25
D3 (mg/m2/day)	350	9	19	32	19

3.7. Noise Monitoring

Under Schedule D Donohill landfill is required to carry out noise monitoring at four stations on-site (N1 – N4) and two sensitive locations off-site (S1 & S2). Noise monitoring was carried out on site on 30th October 2009 between the hours of 10:24 and 13:53, the results are summarised in Table 3.16. The findings of this monitoring event are presented below with the full report attached as Appendix 7.

Table 3.16 Noise Monitoring Results 2009

Station No.	LA_{EQ}	Daytime Limit	Comment
S1	**67**	55	Main noise source was produced by vehicles driving to and from the landfill and lorries idling onsite. Interference noise from passing traffic on R497 (43 cars and 2 HGVs)
S2	**61**	55	No audible noise from the landfill. Interference included rain falling on the ground and traffic movements on the R497 road (3 cars).
N1	53	55	Plant idling and in operation, vehicle movement, reverse siren. Interference from traffic on the R497, the wind blowing, birds singing and trains passing.
N2	55	55	Plant idling and in operation, vehicle movement, reverse siren, people talking, waste bags being dropped at the recycling centre. Interference from traffic on the R497, the wind blowing, rainfall, a plane passing overhead and trains passing and sounding their horns.
N3	53	55	Low level of noise from the landfill. Noise source from traffic movement onsite, idling plant and workers talking. Interference from traffic on the R497, wind blowing, birds singing, dogs barking, train passing and sounding its horn.
N4	50	55	Main sources of noise were generated by lorries and cars driving t and from site and idling on the weighbridge (3 cars and 2 HGVs). Interference from traffic on the R497, rain falling and a train passing.

Noise levels exceeded the licensed levels at two locations, S1 and S2. The exceedances at S1 and S2 can be attributed outside interferences, as none of the onsite noise monitoring locations exceeded the daytime limit of 55dB(A). The noise sensitive monitoring locations are both located on the side of a road and the main source of noise would be passing traffic.

3.8. Sludge Analysis

Condition 5.7 of the waste licence states that, twice yearly, analysis is required for all sludges landfilled at Donohill Landfill. Merck, Sharpe & Dohme, Ballydine, Ireland Ltd. is the only company currently landfilling sludges at the facility. Chemical testing of this sludge was carried out on four occasions during 2009. One of the samples was taken in the presence of Denis Maguire; Executive Chemist for STCC, all analysis was carried out by independent agencies. Table 3.17 details the monitoring results for the sludge. Total tonnage sent to Donohill Landfill during 2009 was 541.5 tonnes.

Table 3.17 Wastewater Treatment & Potable Water Sludge analysis results 2009 from Merck, Sharpe & Dohme (IPPC REG. NO. P0011-03)

PARAMETER	MONITORING FREQUENCY	1st Qtr 23-Mar-09	2nd Qtr 09-Jun-09	3rd Qtr 15-Sep-09	4th Qtr 12-Nov-09
Sludge Analysis Data					
% Solids	Quarterly	98	94	91	96
% Water	Quarterly	2	6	9	4
% Organic Matter (dry basis)	Quarterly	43	39	29	32
% Ash (dry basis)	Quarterly	57	61	71	68
Heavy Metals	Quarterly	% (w/w)	% (w/w)	% (w/w)	% (w/w)
Arsenic		<0.0001	0.0001	0.0001	0.0001
Tin		<0.0001	<0.0001	<0.0001	0.0001
Mercury		<0.0001	<0.0001	<0.0001	<0.0001
Chromium		0.0012	0.0011	0.0011	0.0013
Phosphorus		0.011	0.014	0.004	0.002
Zinc		0.0123	0.0085	0.0076	0.0083
Cadmium		<0.0001	<0.0001	<0.0001	<0.0001
Lead		0.0002	0.0001	0.0002	0.0002
Cobalt		0.0001	0.0001	0.0001	0.0001
Nickel		0.0034	0.0015	0.0013	0.0020
Iron		1.40	1.20	1.545	2.06
Boron		0.0074	0.0061	0.0068	0.0067
Manganese		0.0087	0.0058	0.0101	0.0107
Magnesium		0.39	0.32	0.197	0.224
Calcium		15.4	5.6	13.4	14.7
Copper		0.0006	0.0004	0.0005	0.0006
Aluminium		0.0584	0.0413	0.0046	0.0573
Berylium		<0.0001	<0.0001	<0.0001	<0.0001
Strontium		0.0014	<0.0001	0.0145	0.0157
Barium		0.0073	0.0069	0.0083	0.0078
Sodium		0.19	0.22	0.073	0.142
Potassium		0.17	0.08	0.039	0.034
Molybdenum		0.0001	0.0001	0.0001	0.0001
Selenium		0.0012	0.0031	0.0004	0.0002
Antimony		<0.0001	<0.0001	<0.0001	<0.0001

Note: 1) Heavy Metals testing conducted by Bord na Mona Lab., Newbridge.

Table 3.17 (contd.) Merck Sharp & Dohme -IPPC REG. NO. P0011-03
Wastewater Treatment & Potable Water Sludge analysis results 2009.

PARAMETER	MONITORING FREQUENCY	1st Qtr 23-Mar-09	2nd Qtr 09-Jun-09	3rd Qtr 15-Sep-09	4th Qtr 12-Nov-09
Sludge Analysis Data					
% Solids	Quarterly	98	94	91	96
% Water	Quarterly	2	6	9	4
% Organic Matter (dry basis)	Quarterly	43	39	29	32
% Ash (dry basis)	Quarterly	57	61	71	68
Nutrients & additional parameters	Information	% (w/w)	% (w/w)	% (w/w)	% (w/w)
Ammonia - N		0.0875	0.1390	0.1002	0.0706
Nitrate (as N)		0.0003	0.0004	0.0005	0.0002
Nitrite (as N)		0.0018	<0.0001	<0.0001	<0.0001
Kjeldahl Nitrogen (as N)		1.4868	3.7967	1.8228	1.7806
Chloride (as Cl)		0.1074	0.0305	0.0939	0.1650
Fluoride (as F)		<0.0001	<0.0001	<0.0001	<0.0001
Sulphate (as SO4)		0.2046	0.0261	0.0348	0.1056
Total Extractable Organic Halides (as Cl)	Information	0.0010	0.0013	0.0011	0.0011

Notes:

1) Nutrients testing conducted by Bord na Mona Lab., Newbridge.
2) Total Extractable Organic Halide testing conducted by Chemex laboratory, Cambridge (UK).

Table 3.17 (contd.) Merck Sharp & Dohme -IPPC REG. NO. P0011-03
Wastewater Treatment & Potable Water Sludge Leachate analysis results 2009.

PARAMETER	MONITORING FREQUENCY	1st Qtr 23-Mar-09	2nd Qtr 09-Jun-09	3rd Qtr 15-Sep-09	4th Qtr 12-Nov-09
Leachate Analysis					
Heavy Metals	Quarterly	% (w/v)	% (w/v)	% (w/v)	% (w/v)
Arsenic		<0.00001	<0.00001	<0.00001	<0.00001
Tin		<0.00001	<0.00001	<0.00001	<0.00001
Mercury		<0.00001	<0.00001	<0.00001	<0.00001
Chromium		0.00001	0.00001	<0.00001	<0.00001
Phosphorus		0.0027	0.00195	0.00073	0.00224
Zinc		0.00031	0.00032	0.00004	0.00014
Cadmium		<0.00001	<0.00001	<0.00001	<0.00001
Lead		<0.00001	<0.00001	<0.00001	<0.00001
Cobalt		<0.00001	0.00002	<0.00001	<0.00001
Nickel		0.00001	0.00003	0.00003	0.00005
Iron		0.0080	0.0049	0.0014	0.0010
Boron		0.00014	0.00012	0.00006	0.00006
Manganese		0.00004	0.00003	0.00002	0.00001
Magnesium		0.0157	0.0099	0.0041	0.0047
Calcium		0.0241	0.0100	0.0138	0.0101
Copper		<0.00001	<0.00001	<0.00001	<0.00001
Aluminium		0.00003	0.00003	0.00002	0.00002
Berylium		<0.00001	<0.00001	<0.00001	<0.00001
Strontium		0.00003	0.00003	0.00003	0.00002
Barium		0.00022	0.00018	0.00007	0.00033
Sodium		0.0238	0.0186	0.0059	0.0105
Potassium		0.0142	0.0033	0.0025	0.0020
Molybdenum		<0.00001	0.00001	<0.00001	<0.00001
Selenium		<0.00001	<0.00001	<0.00001	<0.00001
Antimony		<0.00001	<0.00001	<0.00001	<0.00001
Nutrients & additional parameters	Information				
Ammonia - N		<0.00001	0.0010	0.0228	0.0107
Nitrate (as N)		0.00002	0.00003	<0.00001	0.00001
Nitrite (as N)		0.00019	0.00029	0.00020	0.00002
Kjeldahl Nitrogen (as N)		0.1327	0.1441	0.0636	0.0652
Chloride (as Cl)		0.0110	0.0094	0.0051	0.0160
Fluoride (as F)		<0.00005	<0.00001	<0.00001	<0.00001
Sulphate (as SO4)		0.0200	0.0134	0.0050	0.0102
Non-Purgeable Organic Carbon (as C) – *g/lt*		4.72 *g/lt*	4.50 *g/lt*	2.18 *g/lt*	2.43 *g/lt*
Chemical Oxygen Demand – *g/lt*		17.44 *g/lt*	18.99 *g/lt*	9.54 *g/lt*	8.74 *g/lt*
Total Dissolved Solids – *g/lt*		10.82 *g/lt*	12.62 *g/lt*	6.11 *g/lt*	7.18 *g/lt*

Note: 1) Heavy Metals & nutrients testing conducted by Bord na Mona Lab., Newbridge.

Table 3.17 (contd.) Merck Sharp & Dohme -IPPC REG. NO. P0011-03
Wastewater Treatment & Potable Water Sludge Leachate analysis results 2009.

PARAMETER	MONITORING FREQUENCY	1st Qtr 23-Mar-09	2nd Qtr 09-Jun-09	3rd Qtr 15-Sep-09	4th Qtr 12-Nov-09
Leachate Analysis					
Toxicity Testing	Quarterly				
48 hour EC_{50} to Daphnia Magna		4.0 TU	<10 TU	<5.6 TU	<5.6 TU
5 mins. EC_{50} to Vibrio fisheri		8.0 TU	4.7 TU	4.1 TU	3.4 TU
15 mins. EC_{50} to Vibrio fisheri		9.8 TU	11.6 TU	4.0 TU	5.3 TU
Organic Compounds	Bi-Annually	% (w/v)		% (w/v)	
Acetic Acid		0.0650		0.0402	
Acetonitrile		<0.00005		<0.00005	
Dimethylformamide		<0.0001		<0.0001	
Ethylene Glycol		<0.0001		0.0015	
Isopropyl Acetate		<0.00001		<0.00001	
Ethyl Acetate		<0.00005		<0.00005	
Tetrahydrafuran		<0.00005		<0.00005	
Acetone		0.00016		0.00009	
Ethanol		0.0045		0.0071	
Methanol		0.00015		0.00006	
Propan-2-ol		<0.00005		<0.00005	
1,2,3-Trichlorobenzene		<0.000001		<0.000001	
1,3,5-Trimethylbenzene		<0.000001		<0.000001	
Benzene		<0.000001		<0.000001	
Carbon Tetrachloride		<0.000001		<0.000001	
Chloroform		<0.000001		<0.000001	
Chlorobenzene		<0.000001		<0.000001	
Dichloromethane		<0.000001		<0.000001	
Ethylbenzene		<0.000001		<0.000001	
o-Xylene		<0.000001		<0.000001	
m,p-Xylene		<0.000001		<0.000001	
n-Propyl Benzene		<0.000001		<0.000001	
Naphthalene		<0.000001		<0.000001	
Styrene		<0.000001		<0.000001	
Toluene		<0.000001		<0.000001	
Trichloroethene		<0.000001		<0.000001	

Notes:
1) Toxicity testing conducted by Enterprise Ireland Laboratory, Shannon.
2) Toxicity testing per water extraction method DIN - 38414 - S4.
3) Organic Compounds testing conducted by Bord na Mona Lab., Newbridge.
4) Testing conducted using US EPA 524.2 GC/MS method, GC/FID and HPLC.

3.9. Estimated Landfill Gas Emissions

Landfill gas quantities generated at the site have been predicted with the aid of the Landfill Gas Emissions Model (LandGEM-Version 3.02). LandGEM provides an automated tool for quantifying emission rates for methane, carbon dioxide, non methane organic compounds, and individual air pollutants from municipal solid waste (MSW) landfills. The model was developed by the Control Technology Centre (CTC) of the U.S. Environmental Protection Agency and can be obtained by downloading from the TTNWeb (http:\www.epa.gov/ttn/catc/).

The model is based on a first order decay equation and can be run using site specific data for the parameters needed to estimate emissions or, if no site specific data is available, using default values.

The AP-42 set of default values was used in the prediction. This set of values is based on emissions factors in the USEPA Compilation on Air Pollutant Emission Factors, AP-42. This set of default values produces more representative emission values and can be used to produce typical emission estimates in the absence of site-specific test data.

The landfill gas calculations are attached in Appendix 8. In summary 2,271,000m^3 of landfill gas was generated in 2009. 426,227m^3 of landfill gas was flared in 2009. Therefore 1,844,733m^3 of landfill gas was emitted to atmosphere in 2009.

Figure 3.8 graphs estimated methane and landfill gas production, assuming a 50% v/v ration for methane gas and carbon dioxide.

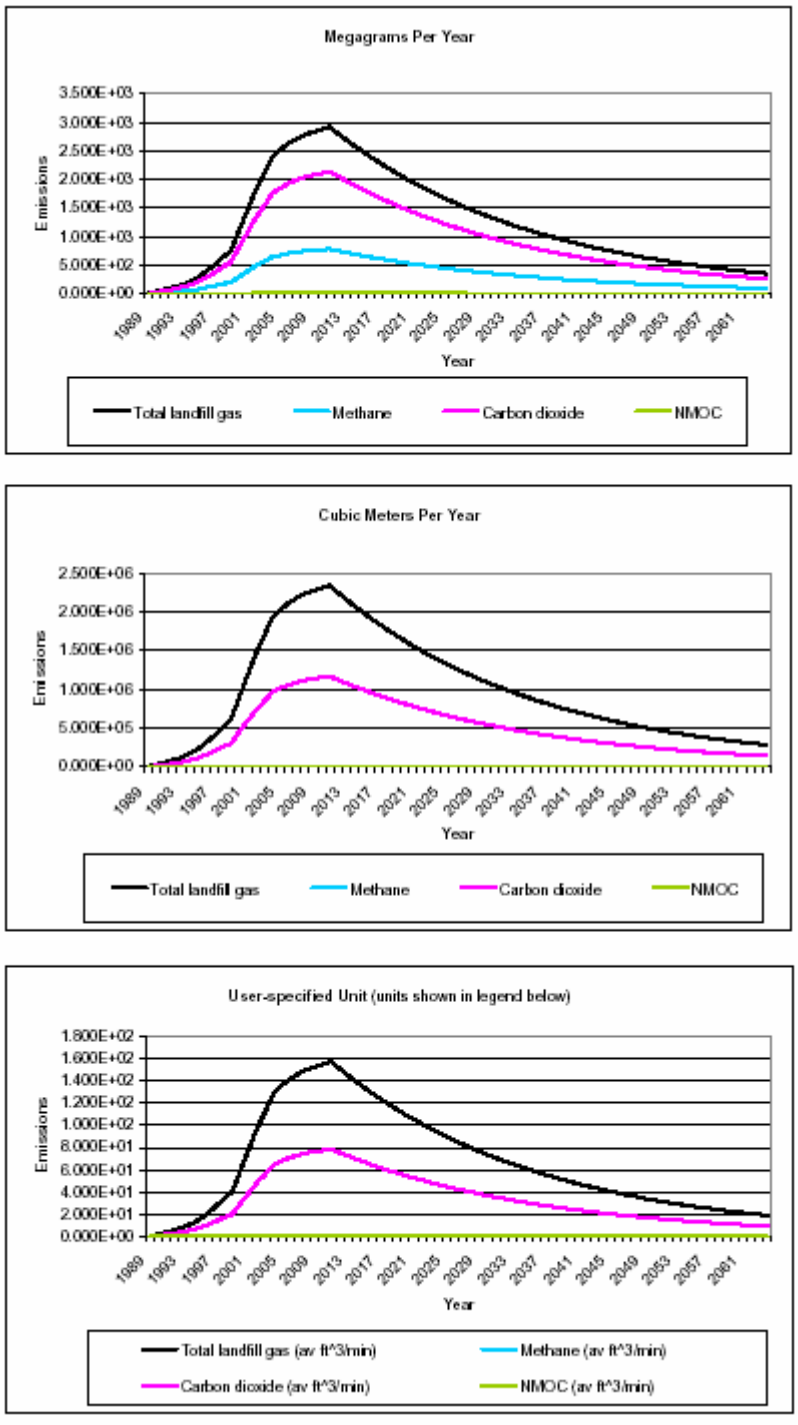


Figure 3.8 Estimate of Landfill Gas Production

3.10. Estimated Indirect Emissions to Groundwater

An estimate of emissions to groundwater can be made by using the hydrogeological properties of the underlying strata, assuming a leachate head and calculating a vertical throughput.

Using the parameters for the underlying strata given in the original waste licence application, the vertical leachate leakage is estimated for Area 1 (unlined) and Area 2 (lined) of the landfill using the following calculation:

$$\text{Leakage} = \left[\frac{K_{aug} \times h_{aug}}{b_{aug}} \right] \times A$$

	Area 1	**Area 2**	**Area 3**	
K_{aug} (hydraulic conductivity)	3.2×10^{-7}	1.0×10^{-9}	1.0×10^{-9}	m/sec
b_{aug} (thickness)	28	28	28	m
h_{aug} (head of leachate)	2.15	0.1	0.1	m
A (area)	25,190	6,100	7,200	m^2
Calculated	0.000619	0.000000022	0.000000026	m^3/sec
		Total =	0.00062	m^3/sec

The following points should be noted:

- The absorptive capacity of the waste body (depth 20m) is not taken into account in the above calculation
- The volume of leachate actively extracted and tankered off-site for disposal
- The upward head (counteracting the downward leachate movement) from the underlying bedrock aquifer is not taken into account. This will result in overestimate of emissions to groundwater.
- That attenuation of contaminants in the leachate will occur as it passes through the 28m of underlying strata.

The value shown above is an estimate only. The groundwater monitoring results outlined in Section 3.4 show no indication of groundwater contamination by leachate.

3.11. Meteorological Data

Under Condition 8 and Schedule D.6 meteorological data is to be collected from the Kilkenny meteorological station, however due to the installation of a weather station at Donohill, meteorological data is now collected directly onsite. The following details are to be recorded on a daily basis:

- Precipitation Volume
- Temperature (min/max.)
- Wind Force and Direction
- Evaporation
- Evapotranspiration
- Humidity
- Atmospheric Pressure

See appendix 9 for a full record of meteorological data for 2009.

3.12. Slope Stability

The landfill side slopes are considered stable in the long term provided that leachate levels are maintained close to the base of the waste body at levels which were typically recorded during 2009 monitoring.

The full report can be seen in Appendix 10.

4. SITE DEVELOPMENT WORKS

Site development works initiated or completed during the report period are described hereunder.

4.1 Site Development

In 2009:

- Training carried out with site staff on handling of hazardous waste.
- New fencing erected along the site boundary by canteen.
- EMAS accreditation received
- Spill Kit Training carried out with site staff
- Road markings put in place to improve traffic management
- Leachate wells cleaned out and de-sludged
- Bunded area installed in hazardous waste container for the waste paint area.
- Liner on surface water lagoon repaired
- Remote log in system set up for the flare
- Section of tarmac on the site road relaid due to wear and tear causing large potholes.

Planned for 2010

- Permanently cap a further portion of Area 1 / 3.
- Install additional gas and leachate extraction wells in Areas 1 and 3.
- Improve the drainage system at the Civic Amenity.
- Improve site signage
- Install new fencing along the road from the weighbridge to the corner of area 3.
- Carry out further landscaping works at the site entrance.
- Implement OHSAS 18000 Health and Safety Management System.
- Install horizontal gas extraction system in Area 4.

4.2 Restoration of Completed Cells/Phases

Capping of the majority of area 1 and all of area 2 commenced in October 2005 and was completed in March 2006. The cap covers an area of 20,230 m^2 and includes surface water drainage infrastructure as well as permanent gas collection infrastructure and additional gas collection wells.

An Aftercare and Restoration Plan was submitted to the Agency in December 2004.

4.3 Remaining Capacity of the Landfill

In accordance with Condition 8.7 of the licence, Focus Surveys Ltd conducted a topographical survey of the site including the void space analysis, on the 09th of October 2009. A copy of the report is included as Appendix 11. The analysis estimates the remaining potential capacity of the landfill as 39,800 m^3.

4.4 Tank, Pipeline and Bund Testing

The surface water and leachate lagoons were both integrity tested in 2008. Both lagoons passed. This testing is carried out every three years and was not due to be done in 2009.

A copy of the test certificate for the waste paint bund is shown in Appendix 12.

5 ENVIRONMENTAL INCIDENTS AND COMPLAINTS

5.1 Incidents Summary

Condition 11.2 of the waste licence requires that the licensee shall make written records of environmental incidents. Table 5.1 details recorded incidents during the reporting period. Corrective actions taken in response to incidents and complaints are in accordance with the requirements of the licence and with the site Corrective Action Procedure. Copies of all written records of environmental incidents for the reporting period are contained in Appendix 13.

Nine incidents were recorded during this reporting period

Table 5.1 Incidents Summary

Date	12-0-09
Nature of Incident	Leachate trigger level exceeded at LGE8
Cause	Heavy rainfall
Corrective Action	Leachate being pumped down and tankered offsite
Open / Closed	Closed
Date	02-02-09
Nature of Incident	Leachate trigger level exceeded at LE7
Cause	Heavy rainfall
Corrective Action	Leachate being pumped down and tankered offsite
Open / Closed	Closed
Date	27-02-09
Nature of Incident	Landfill gas trigger level exceeded at GM12
Cause	Insufficient gas extraction from part of Area 1
Corrective Action	Capping and additional gas well installation planned.
Open / Closed	Open
Date	30-04-09
Nature of Incident	Flare not starting
Cause	UV sensor not working
Corrective Action	UV sensor cleaned and dried.
Open / Closed	Closed
Date	17-06-09
Nature of Incident	Leachate trigger level exceeded at LGE8 & LE7
Cause	Heavy rainfall
Corrective Action	Leachate being pumped down and tankered offsite
Open / Closed	Closed
Date	07-07-09
Nature of Incident	Leachate trigger level exceeded at LE7 & LGE7
Cause	Heavy rainfall
Corrective Action	Leachate being pumped down and tankered offsite
Open / Closed	Closed
Date	31-08-09
Nature of Incident	Leachate trigger level exceeded at LE7
Cause	Heavy rainfall
Corrective Action	Leachate being pumped down and tankered offsite
Open / Closed	Closed

Date	04-09-09
Nature of Incident	Leachate trigger level exceeded at LGE7 and LGE8
Cause	Heavy rainfall
Corrective Action	Leachate being pumped down and tankered offsite
Open / Closed	Closed

Date	08-10-09
Nature of Incident	Leachate trigger level exceeded at LE7, LGE7 & LGE8
Cause	Heavy rainfall
Corrective Action	Leachate being pumped down and tankered offsite
Open / Closed	Closed

5.2. Complaints Summary

No complaints were received during the reporting period.

5.3 Review of Nuisance Controls.

All nuisance control systems are monitored weekly to ensure that they are working effectively. The findings of these inspections are recorded on Nuisance Check Sheets, which are held on record in the facility. Environmental nuisances include:

1. Litter
2. Bird
3. Vermin & Insects
4. Odour
5. Dust

5.3.1 Litter Control

There are a number of systems in place to control litter.

1. Deposited waste is compacted, this ensures that the maximum use is made of void space within the landfill but also reduces the amount of waste available to generate litter
2. There is litter netting positioned around the active area of the site to capture any loose litter blown off the active area
3. Any litter that gets past the netting will be identified in the site inspection and litter picking is carried out as required
4. All waste deposited on site is covered at the end of each working day to stop scavenging and ensure that deposited waste does not blow away as litter
5. Waste will not be deposited on-site when there are adverse wind conditions

5.3.2 Bird Control

Bird control on-site is contracted out to Bird Control Ireland but is done in conjunction with STCC personnel. They use several systems to control birds on site:

1. Fly Falcons and Hawks
2. Use species specific distress calls
3. Use fixed distress calling unit with speakers.
4. Fly various types of kite
5. Fly holographic streamers
6. Use bird scaring cartridges
7. Use of a shotgun

Bird Control Ireland's report relating to the reporting period has been included as Appendix 14.
In summary, of the 12 month period covered, birds were only present on-site for eight months.

5.3.3 Vermin & Insects Control

The initial vermin control system on site is prompt waste disposal and compaction, reducing access to material. Additional vermin control work is contracted to Pest Patrol (Pest control and Environmental Services). They use the following systems to control vermin and insects on site:

1. Spraying is used to control insects
2. Bait boxes are used to capture vermin.

Pest Patrol carries out eight to ten site inspections annually to ensure that the site is free of insects and vermin. Pest Patrol has installed forty-two bait boxes around the perimeter of the site, which are inspected and freshly baited during each visit. STCC has also contracted Pest Patrol to install bait boxes in twenty locations adjacent to the landfill site at local dwellings. These traps are also inspected during site visits. Donohill landfill is not considered to have an insect or vermin problem.

5.3.4 Odour Control

STCC use the following systems on site to control odour:

1. All waste is compacted post placement
2. Daily cover
3. Excavating the waste body is avoided where possible

5.3.5 Dust Control

Dust control on-site is controlled using the following systems:

1. Reduced vehicle speed on site to control dust rising
2. Roads sprayed with water to keep dust down, done in dry weather

No complaints were received at the landfill as regards dust raised by operational activities.

6 SUMMARY OF PROCEDURES ASSOCIATED WITH THE FACILITY

Documented procedures governing the operation of the facility are outlined below. Complete copies of all procedures are included in the facility's EMS.

Procedure Title	**Emergency Response Procedure**
Summary	The purpose of this procedure is to propose appropriate actions to ensure the safety & health of all site personnel and visitors, minimise damage to property and risk to the environment This procedure describes the action to be used in the event of an emergency where an emergency can be described as but is not limited to any of the following incidences:
Revision Date & No.	September 2009; Rev. 7

Procedure Title	**Corrective Action Procedure**
Summary	To ensure that the appropriate corrective action is taken in the event of an incident on-site, where an incident can be defined as: • an emergency • any emission which does not comply with the requirements of this licence (W0074-02) • any trigger level specified in this licence which is attained or exceeded • any indication that environmental pollution has, or may have, taken place
Revision Date & No.	November 2006; Rev. 3

Procedure Title	**Awareness and Training Procedure**
Summary	To ensure that training needs are identified and appropriate training is provided for facility personnel.
Revision Date & No.	June 2004; Rev.2

Procedure Title	**On-Site Communication Procedure**
Summary	To ensure that members of the public can access, at the facility, information on the sites environmental performance, in compliance with Condition 2.4.1 of the waste licence
Revision Date & No.	July 2006; Rev. 3

Procedure Title	**External Communication Procedure**
Summary	To ensure that all communications regarding the landfill facility are correctly directed to be addressed by the correct personnel.
Revision Date & No.	April 2009; Rev. 4

Procedure Title	**Complaints Procedure**
Summary	To ensure that all complaints that landfill activities are creating a nuisance are recorded and dealt with, in compliance with Condition 10.4 of the waste licence
Revision Date & No.	April 2009, Rev. 6

Procedure Title	**Waste Characterisation and Testing Procedure**
Summary	To provide a system of checking to ensure that waste to be disposed of at Donohill Landfill complies with Schedule A of the Waste Licence.
Revision Date & No.	July 2006; Rev. 2

Procedure Title	**Waste Acceptance & Rejection Procedure**
Summary	To formalise the system of receiving and recording the delivery and acceptance of waste.
Revision Date & No.	December 2009; Rev 0

Procedure Title	**Vehicle Movement Procedure**
Summary	Ensure that all disposal vehicles using the site enter, travel and discharge waste safely
Revision Date & No.	October 2007; Rev. 6

Procedure Title	**Leachate Handling Procedure**
Summary	To formalise the system of leachate handling on-site, during removal from the leachate lagoon and its subsequent removal to Tipperary Town Waste Water Treatment Plant.
Revision Date & No.	July 2007; Rev. 3

Procedure Title	**Environmental Monitoring Procedure**
Summary	To formalise the system of environmental monitoring on-site for: • Landfill Gas • Surface Water, Groundwater and Leachate • Meteorological data • Dust • Noise
Revision Date & No.	April 2009; Rev. 5

Procedure Title	**High Winds Procedure**
Summary	To ensure that the correct action is taken on site during conditions of high wind
Revision Date & No.	July 2006; Rev. 2

Procedure Title	**Site Inspection Procedure**
Summary	To ensure that the site is inspected on a weekly basis to ensure that there is nothing of note occurring on site that is being missed.
Revision Date & No.	April 2009; Rev. 4

Procedure Title	**Nuisance Inspection Procedure**
Summary	To ensure that the site is inspected on a weekly basis to ensure that there is no nuisance being caused by vermin, birds, flies, mud, dust, litter and odours.
Revision Date & No.	July 2006; Rev. 2

Procedure Title	**Leachate Management Procedure**
Summary	To effective manage the leachate produced onsite.
Revision Date & No.	April 2009; Rev 4

Procedure Title	**Landfill Gas Management Procedure**
Summary	To effectively manage the onsite landfill gas system.
Revision Date & No.	April 2009; Rev 3

Procedure Title	**Odour Impact Assessment Procedure**
Summary	To carry out odour assessments.
Revision Date & No.	April 2009; Rev 1

Procedure Title	**Machines Working at the Tip Face Procedure**
Summary	To describe the operation procedure for machines working at tip face.
Revision Date & No.	April 2008; Rev. 0

Procedure Title	**Litter Netting Procedure**
Summary	To define how litter netting is erected and taken down
Revision Date & No.	April 2008 Rev. 0

Procedure Title	**Hessian Procedure**
Summary	To define how the waste is covered with Hessian
Revision Date & No.	April 2008 Rev. 0

Procedure Title	**Site Supervision Procedure**
Summary	To ensure there is adequate supervision on the site at all times
Revision Date & No.	August 2008, Rev. 0

Procedure Title	**Surface Water Lagoon Management Procedure**
Summary	To ensure the surface water is properly managed
Revision Date & No.	October 2008, Rev. 0

Procedure Title	**Working at the Lagoon Enclosure Procedure**
Summary	To define how to work safely at the lagoon area.
Revision Date & No.	June 2008

Procedure Title	**Compactor Skip Procedure**
Summary	To ensure the compactor skip is operated in a safe manner
Revision Date & No.	October 2009; Rev 0

Procedure Title	**Litter Picking Procedure**
Summary	To ensure litter picking is carried out in a safe manner
Revision Date & No.	October 2009; Rev 0

Procedure Title	**Waste Handling Procedure**
Summary	To ensure waste is handled in a safe manner
Revision Date & No.	October 2009; Rev 0

7 FACILITY RESOURCES

7.1 Management and Staff Structure

There are six operational staff at the landfill site: a Facility Manager, responsible for the day-to-day site activities, a deputy manager, environmental chemist, a weighbridge operator and two general operatives.

A staffing structure for site operations is presented in Figure 7.1. Their qualifications and responsibilities are outlined below:

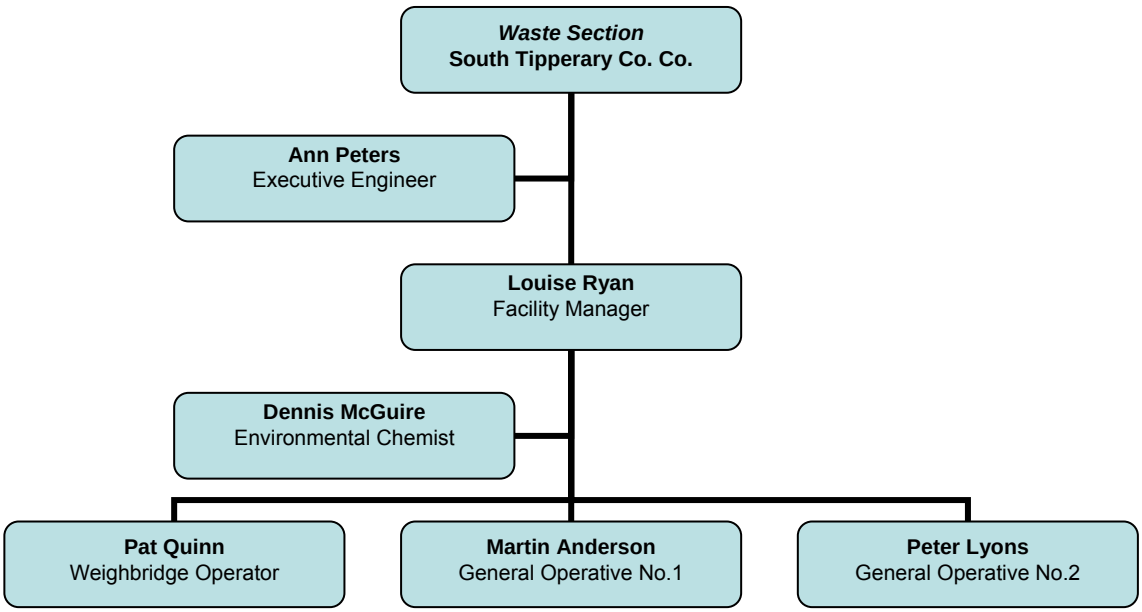


Figure 7.1 Management Structure

Facility Manager:	*Louise Ryan*
Qualifications:	B.Sc. (Environmental Science) FAS SafePass Course
Responsibilities:	Day-to-Day Operations Waste Acceptance Environmental Protection

Executive Engineer:	*Anne Peters*
Qualifications:	B.E. (Chem.) FAS Waste Management Training Course FAS SafePass Course
Responsibilities:	Oversee infrastructure development and management on site

Chemist:	*Dennis McGuire*
Qualifications:	B.Sc.
Responsibilities:	Responsible for analytical analysis of monitoring on site

Deputy Manager:	*Pat Walsh*
Qualifications:	FAS Waste Management Training Course FAS SafePass Course
Responsibilities:	Deputy for the Facility Manager, has the same responsibilities • Day-to-day operations • Waste acceptance • Environmental protection

Weighbridge Operator	*Pat Quinn*
Qualifications:	In –house Training • Weighbridge operation • Instruction on the implication of the waste licence on site staff
Responsibilities:	• Weighing • Waste Acceptance • Records • Cash Duty

Staff will be present on site during operational hours to supervise the waste disposal, deal with any emergency that arises and to prevent unauthorised entry into the site. The Facility Manager, or appointed deputy, must be on site during opening hours.

The primary goal of all training is to ensure that there is awareness at all levels of:

- the importance of compliance with conditions of the licence
- the potential environmental effects of work activities
- individual roles and responsibilities in achieving compliance with the waste licence
- the environmental benefits of improved performance
- the Health, Safety & Welfare at Work Act.

7.1.1 Training of Personnel

It will be the responsibility of the Landfill Manager to ensure that all landfill staff receives training in relevant areas/tasks, including:

- instruction and operation of the landfill machinery
- operation of the weighbridge and computer system
- training for specific functions, e.g. bird control devices, gas monitoring, vermin/fly control and leachate monitoring.

The Landfill Manager shall also ensure that all staff receives general training, including:

- instruction in manual handling
- the use of fire extinguishers
- FAS SafePass Course
- First Aid training

It is also the responsibility of the Landfill Manager to ensure that site staff are aware of the terms of the waste licence at the facility and the responsibility of each staff member to maintain specific terms of the waste

licence. It is the responsibility of the facility manager to ensure that each staff member is aware of his or her specific function.

The Health and Safety Officer makes regular visits to the site, to promote awareness of safety issues and to audit the site. Any suggested improvements are implemented as soon as possible.

7.1.2 Records for the Training and Awareness Programme

- A training records file is kept at the site office
- All relevant operational procedures and documentation relevant to the licence shall be kept at the facility office and updated regularly
- All staff shall be made aware of the existence of such documents.

7.2 Financial Provisions

STCC charged €125 per tonne for disposal of waste at Donohill landfill during most of 2009. The charge was reduced to €100 per tonne from October 1st 2009, in order to be competitive with other landfills in the region. This charge does not include the landfill levy, which is applied in addition to the gate fee.

This gate fee is adequate to provide for the current operation and development of the site, waste licence compliance and to ensure that the facility will be restored to the satisfaction of the Agency.

7.2.1 Local Community Involvement

Donohill landfill is currently liaising with the Donohill Liaison Committee community group.

STCC holds meetings with this group, for discussions on the facility's impact on the local community and proposals for improving the local area.

In the past five years STCC, as Donohill Landfill has made major contributions to the socio-economic development of the local community. The details of the project types are outlined below.

1. Landscaping works

    a. Picnic tables provided for green area
    b. Resurface car park at the Church
    c. Finish resurfacing of nine boreens / minor roads in Donohill

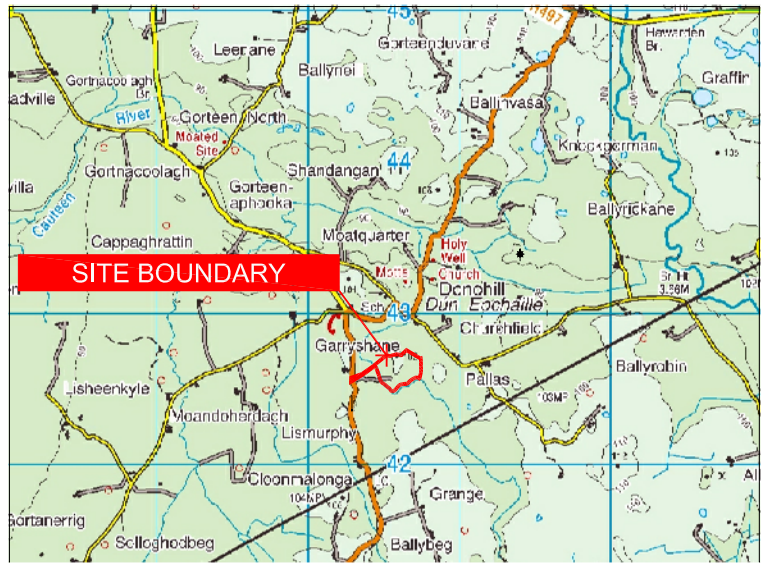
2. Contributed to half the cost of retaining wall and drainage works carried out at turn on Donohill Tipperary roadway

3. Sponsored annual sports day

In total over €521,561 has been invested into the local community by the facility (€80,235 in 2002, €129,994 in 2003, €71,332 in 2004, €60,000 in 2005, €60,000 in 2006, €60,000 in 2007, €40,000 in 2008 and €20,000 in 2009). The money contributed in 2009 was put towards development of a community sports facility.

A financial summary for 2009 can be seen in Appendix 17.

APPENDIX 1 SITE DRAWINGS



SITE LOCATION

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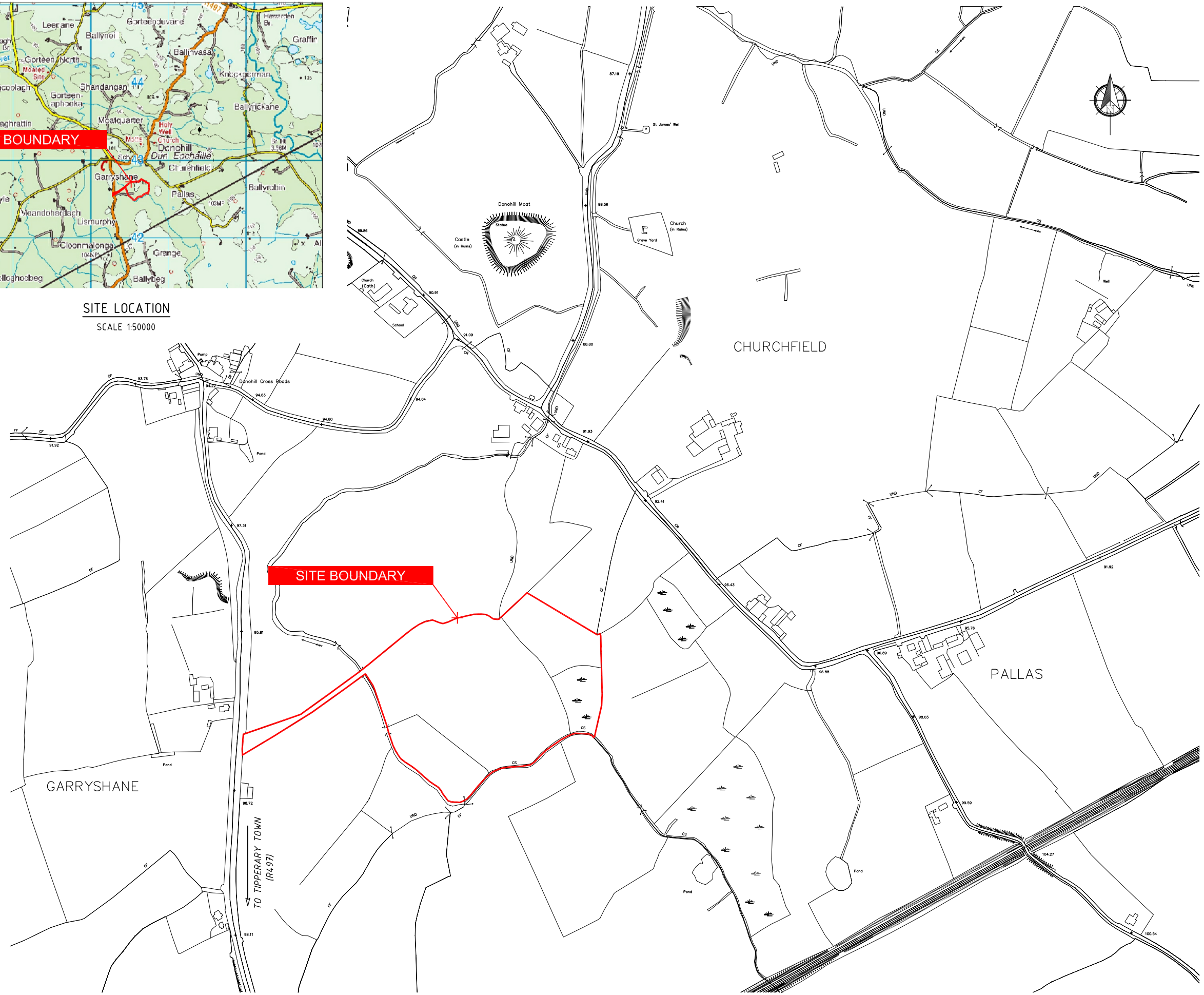

LEGEND:

Site and Waste Licence Boundary

Rev.	Drawn	Chk'd	App'd	
C	AR	CJC	BG	Cork 08.03.10 ISSUE FOR TENDER
				Rev Origin Date Description

Revision History: A | B | C

Name of Client

SOUTH TIPPERARY COUNTY COUNCIL

Name of Job

DONOHILL CAPPING WORKS
PHASE 2

Title of Drawing

SITE LOCATION MAP

Scales Used: 1:5000

This Drawing was printed to A3

Dwg. No.: DE08-024-05-101-001

Rev.: C

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CONSULTANTS IN ENGINEERING & ENVIRONMENTAL SCIENCES
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T:+353-21-4964133, F:+353-21-4964464
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T:+353-1-6583500, F:+353-1-6583501
W: www.fehilytimoney.ie, E: info@ftco.ie

ORIGINAL DRAWING SIZE A1 - (841 x 594)

NATURAL SCALE

I. N. G.
NORTH

GAS MIGRATION

GM1	190476	142588
GM2	190496	142532
GM3	190531	142503
GM4	190567	142470
GM5	190603	142484
GM6	190637	142517
GM7	190687	142532
GM8	190729	142563
GM9	190773	142617
GM10	190768	142666
GM11	190754	142697
GM12 †	190678	142754
GM13 †	190705	142846
GM14 †	190407	142966
GM15 †	190268	142736

GAS MONITORING

G2	190678	142590
G3 ✳	190569	142641
G4	190523	142562

FLARE

F1	190502	142581

LEACHATE COMPOSITION

LC1	190496	142615
LC2	190496	142615
LC3 ✳✳✳	190495	142584
LC4	190495	142600

LEACHATE LEVEL

L2 ✳	190690	142575
L3 ✳	190738	142615
L4	190500	142576
L5	190656	142706

LEACHATE EXTRACTION

LE1	190484	142595
LE2 ✳	190503	142585
LE3	190625	142536
LE4 ✳	190500	142612
LE5	190647	142546
LE6	190690	142575
LE7	190738	142615
LE8	190715	142571
LE9	190698	142635
LE10 ✳✳	190707	142615
LE11 ✳✳	190718	142593
LE12	190521	142612

LEACHATE GAS EXTRACTION

LGE1✳✳✳	190691	142576
LGE3✳✳✳	190498	142650
LGE4✳✳✳	190521	142612
LGE5✳✳✳	190647	142546
LGE6	190620	142609
LGE7	190569	142641
LGE8	190660	142701

HORZ. GAS EXTRACTION

HGEV1/2	190517	142650
HGEV3/4	190514	142581
HGEV5/6/7	190505	142554
HGEV8/9/10	190680	142555

KNOCK-OUT POTS

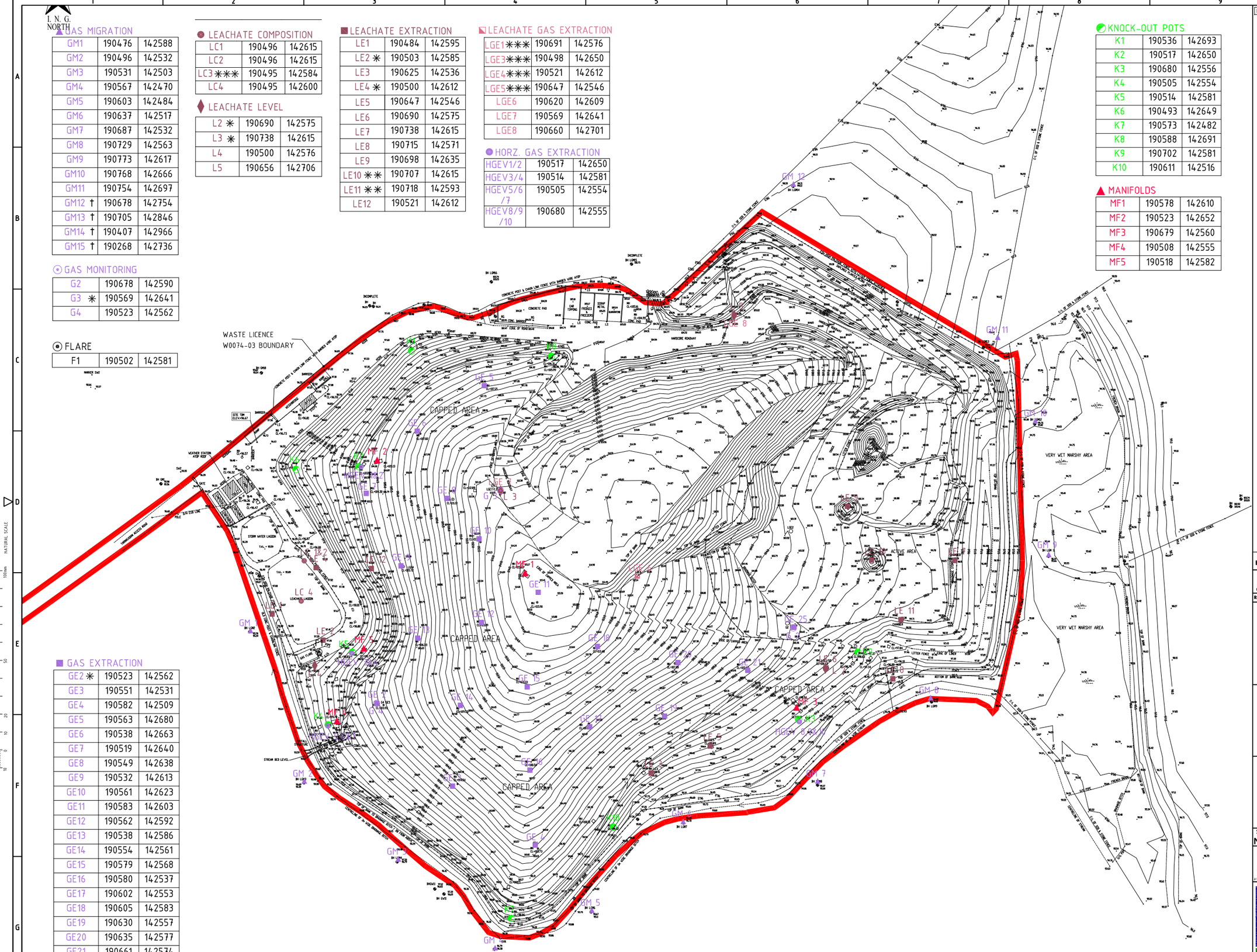
K1	190536	142693
K2	190517	142650
K3	190680	142556
K4	190505	142554
K5	190514	142581
K6	190493	142649
K7	190573	142482
K8	190588	142691
K9	190702	142581
K10	190611	142516

MANIFOLDS

MF1	190578	142610
MF2	190523	142652
MF3	190679	142560
MF4	190508	142555
MF5	190518	142582

GAS EXTRACTION

GE2 ✳	190523	142562
GE3	190551	142531
GE4	190582	142509
GE5	190563	142680
GE6	190538	142663
GE7	190519	142640
GE8	190549	142638
GE9	190532	142613
GE10	190561	142623
GE11	190583	142603
GE12	190562	142592
GE13	190538	142586
GE14	190554	142561
GE15	190579	142568
GE16	190580	142537
GE17	190602	142553
GE18	190605	142583
GE19	190630	142557
GE20	190635	142577
GE21	190661	142574
GE25	190678	142590



NOT FOR CONSTRUCTION UNLESS SPECIFICALLY STATED OTHERWISE

LEGEND :

Gas, Monitoring & Extraction Locations

- Gas Migration
- Gas Monitoring
- Gas Extraction
- Leachate Gas Extraction
- Horizontal Gas Extraction
- Knock-Out Pots
- Manifolds
- Flare

Leachate Monitoring & Extraction Locations

- Leachate Composition
- Leachate Level
- Leachate Extraction

NOTE :

† Denotes not shown on plan. Refer to DE07-024-04-Fig.001.

✳ Location moved since a previous revision.

✳✳ No pumps installed yet.

✳✳✳ Well not in use.

Background Survey Date 09.10.09

Rev.	Drawn	Chkd	Appd		
E	CBC	TR	BG	Cork 22.3.2010	ISSUE FOR AER 2009
				Rev Origin / Date	Description

Revision History: A B C D E

Name of Client

SOUTH TIPPERARY COUNTY COUNCIL

Name of Job

DONOHILL LANDFILL
LICENCE COMPLIANCE 2007

Title of Drawing

GAS AND LEACHATE MONITORING AND EXTRACTION LOCATIONS

Scales Used: NTS

Dwg. No.: DE07-024-04-001

Rev.: E

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T:+353-21-4964133, F:+353-21-4964464
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T:+353-1-6583500, F:+353-1-6583501
W: www.fehilytimoney.ie, E: info@ftco.ie

ORIGINAL DRAWING SIZE A1 - (841 x 594)

NATURAL SCALE 10 0 10 20 50 100mm

Sheet FTC-A1-2006 rev. C (template filed in O:Acad\Templates\Autocad) (May 2007) - template externally referenced (Claire Curran)

GAS MIGRATION

GM1	190476	142588
GM2	190496	142532
GM3	190531	142503
GM4	190567	142470
GM5	190603	142484
GM6	190637	142517
GM7	190687	142532
GM8	190729	142563
GM9	190773	142617
GM10	190768	142666
GM11	190754	142697
GM12 †	190678	142754
GM13 †	190705	142846
GM14 †	190407	142966
GM15 †	190268	142736

LEACHATE COMPOSITION

LC1	190496	142615
LC2	190496	142615
LC3✳✳✳	190495	142584
LC4	190495	142600

GROUNDWATER

GW11S	190545	142493
GW11D	190548	142491
GW12S	190841	142635
GW12D	190845	142638
GW13 †	190700	142846
GW14 †	190412	142965
GW15 †	190286	142741
GW16 †	190070	144050

SURFACE WATER

SW1	190754	142564
SW2	190461	142631
SW3 †	190695	142966
SW4 †	191390	140939
SW5	190481	142623
SW7	190508	142544
SW8	190626	142515

NOISE

N1	190717	142711
N2	190594	142706
N3	190675	142563
N4	190482	142639
S1 †	190293	142606
S2 †	190979	142702

DUST

ST1	190562	142704
ST2B	190737	142700
ST3	190490	142620

FLARE

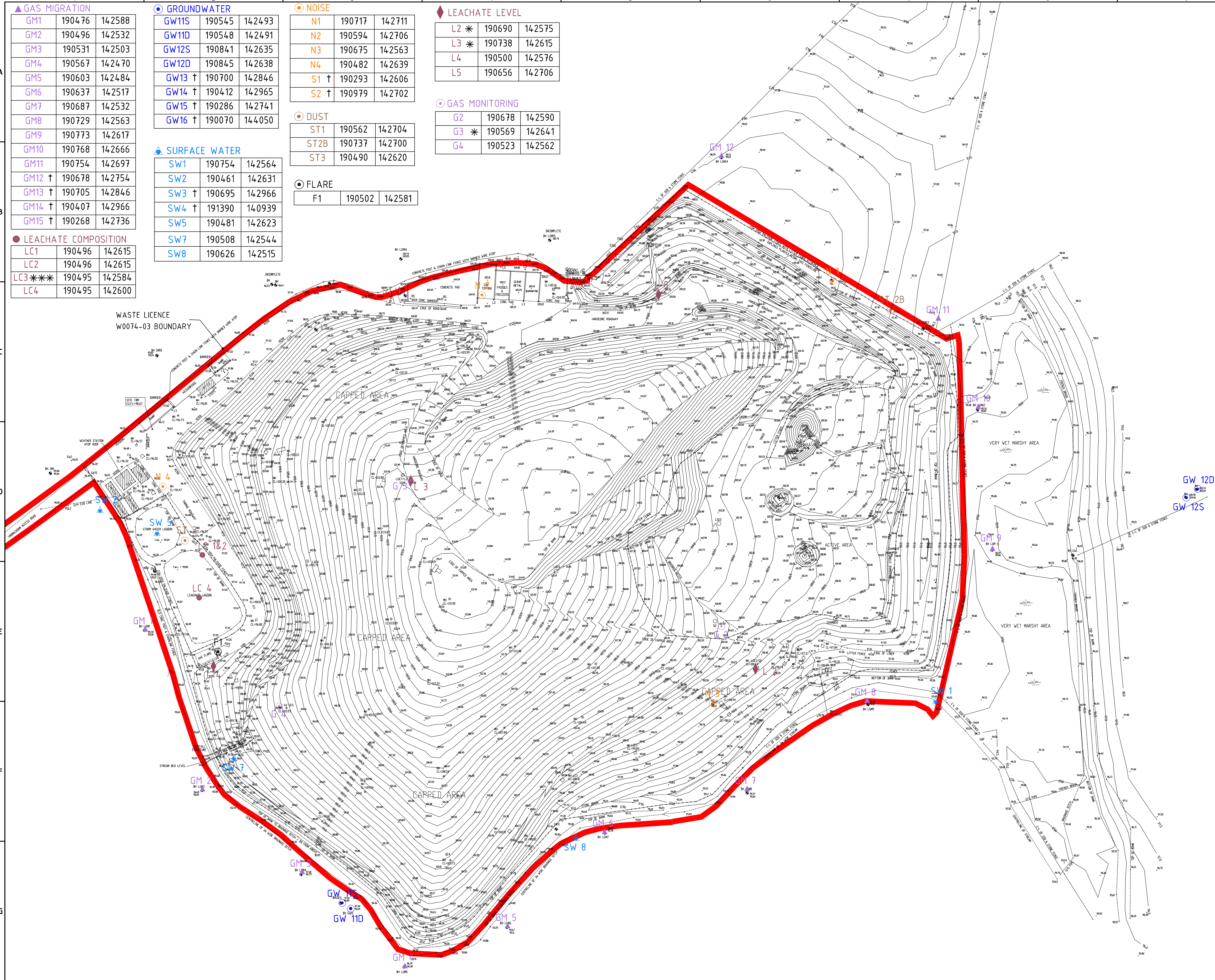
F1	190502	142581

LEACHATE LEVEL

L2 ✳	190690	142575
L3 ✳	190738	142615
L4	190500	142576
L5	190656	142706

GAS MONITORING

G2	190678	142590
G3 ✳	190569	142641
G4	190523	142562



NOT FOR CONSTRUCTION UNLESS SPECIFICALLY STATED OTHERWISE

Do not scale. Use figured dimensions only. If in doubt - Ask!

LEGEND :

Environmental Monitoring Locations

- Groundwater
- Surface Water
- Proposed Surface Water
- Noise
- Dust
- Gas Migration
- Leachate Level
- Gas Monitoring
- Flare
- Leachate Composition

NOTE :

† Denotes not shown on plan. Refer to DE07-024-04-Fig.001.

✳ Location moved since a previous revision.

✳✳ No pumps installed yet.

✳✳✳ Well not in use.

Background Survey Date 09.10.09

Rev.	Drawn	Chk'd	App'd	Rev Origin / Date	Description
F	CBC	TR	BG	Cork 22.3.2010	ISSUE FOR AER 2009

Revision History A B C D E F

Name of Client

SOUTH TIPPERARY COUNTY COUNCIL

Name of Job

DONOHILL LANDFILL
LICENCE COMPLIANCE 2007

Title of Drawing

ENVIRONMENTAL MONITORING LOCATIONS

Scales Used: NTS

Dwg. No.: DE07-024-04-002 | Rev.: F

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CONSULTANTS IN ENGINEERING & ENVIRONMENTAL SCIENCES
Core House, Pouladuff Rd, Cork, Ireland. T:+353-21-4964133, F:+353-21-4964464
Mill House, Ashtown Gate, Navan Rd, Dublin 15, Ireland. T:+353-1-6583500, F:+353-1-6583501
W: www.fehilytimoney.ie, E: info@ftco.ie

ORIGINAL DRAWING SIZE A1 - (841 x 594)

NATURAL SCALE

Sheet FTC-A1-2006 rev. C (template filed in O:Acad\Templates\Autocad) (May 2007) - template externally referenced (Claire Curran)

NATURAL SCALE

NOT FOR CONSTRUCTION UNLESS SPECIFICALLY STATED OTHERWISE

LEGEND :

Noise & Dust
Monitoring Locations

- Noise
- Dust

NOISE

N1	190717	142711
N2	190594	142706
N3	190675	142563
N4	190482	142639
S1 †	190293	142606
S2 †	190979	142702

DUST

ST1	190562	142704
ST2B	190737	142700
ST3	190490	142620

NOTE :

† Denotes not shown on plan.
Refer to DE07-024-04-Fig.001.

Background Survey Date 09.10.09

Rev.	Drawn	Chk'd	App'd	Rev Origin / Date	Description
C	CBC	TR	BG	Cork 22.3.2010	ISSUE FOR AER 2009

Revision History A B C

Name of Client

SOUTH TIPPERARY
COUNTY COUNCIL

Name of Job

DONOHOLL LANDFILL
LICENCE COMPLIANCE 2007

Title of Drawing

NOISE AND DUST MONITORING LOCATIONS

Scales Used: NTS

Dwg. No.: DE07-024-04-003 Rev.: C

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T:+353-1-6583500, F:+353-1-6583501
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ORIGINAL DRAWING SIZE A1 - (841 x 594)

NATURAL SCALE

N. G. FORTH

GROUNDWATER

GW11S	190545	142493
GW11D	190548	142491
GW12S	190841	142635
GW12D	190845	142638
GW13 †	190700	142846
GW14 †	190412	142965
GW15 †	190286	142741
GW16 †	190070	144050

SURFACE WATER

SW1	190754	142564
SW2	190461	142631
SW3 †	190695	142966
SW4 †	191390	140939
SW5	190481	142623
SW7	190508	142544
SW8	190626	142515

LEGEND :

Groundwater & Surface Water Monitoring Locations

- Groundwater
- Surface Water

NOTE :

† Denotes not shown on plan. Refer to DE07-024-04-Fig.001.

Background Survey Date 09.10.09

Rev.	Drawn	Chk'd	Appd	Date	Description
D	CBC	TR	BG	Cork 22.3.2010	ISSUE FOR AER 2009

Revision History: A B C D

Name of Client

SOUTH TIPPERARY COUNTY COUNCIL

Name of Job

DONOHILL LANDFILL
LICENCE COMPLIANCE 2007

Title of Drawing

GROUNDWATER AND SURFACE WATER MONITORING LOCATIONS

Scales Used: NTS

Dwg. No. DE07-024-04-004 — Rev. D

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CONSULTANTS IN ENGINEERING & ENVIRONMENTAL SCIENCES
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T:+353-21-4964133, F:+353-21-4964464
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T:+353-1-6583500, F:+353-1-6583501
W: www.fehilytimoney.ie, E: info@ftco.ie

ORIGINAL DRAWING SIZE A1 - (841 x 594)

NATURAL SCALE 10 0 10 20 50 100mm

N. G. ORTH

▲ GAS MIGRATION

GM1	190476	142588
GM2	190496	142532
GM3	190531	142503
GM4	190567	142470
GM5	190603	142484
GM6	190637	142517
GM7	190687	142532
GM8	190729	142563
GM9	190773	142617
GM10	190768	142666
GM11	190754	142697
GM12 †	190678	142754
GM13 †	190705	142846
GM14 †	190407	142966
GM15 †	190268	142736

⊙ GAS MONITORING

G2	190678	142590
G3 ✳	190569	142641
G4	190523	142562

■ GAS EXTRACTION

GE2 ✳	190523	142562
GE3	190551	142531
GE4	190582	142509
GE5	190563	142680
GE6	190538	142663
GE7	190519	142640
GE8	190549	142638
GE9	190532	142613
GE10	190561	142623
GE11	190583	142603
GE12	190562	142592
GE13	190538	142586
GE14	190554	142561
GE15	190579	142568
GE16	190580	142537
GE17	190602	142553
GE18	190605	142583
GE19	190630	142557
GE20	190635	142577
GE21	190661	142574
GE25	190678	142590

◪ LEACHATE GAS EXTRACTION

LGE1✳✳	190691	142576
LGE3✳✳	190498	142650
LGE4✳✳	190521	142612
LGE5✳✳	190647	142546
LGE6	190620	142609
LGE7	190569	142641
LGE8	190660	142701

● HORZ. GAS EXTRACTION

HGEV1/2	190517	142650
HGEV3/4	190514	142581
HGEV5/6/7	190505	142554
HGEV8/9/10	190680	142555

◔ KNOCK-OUT POTS

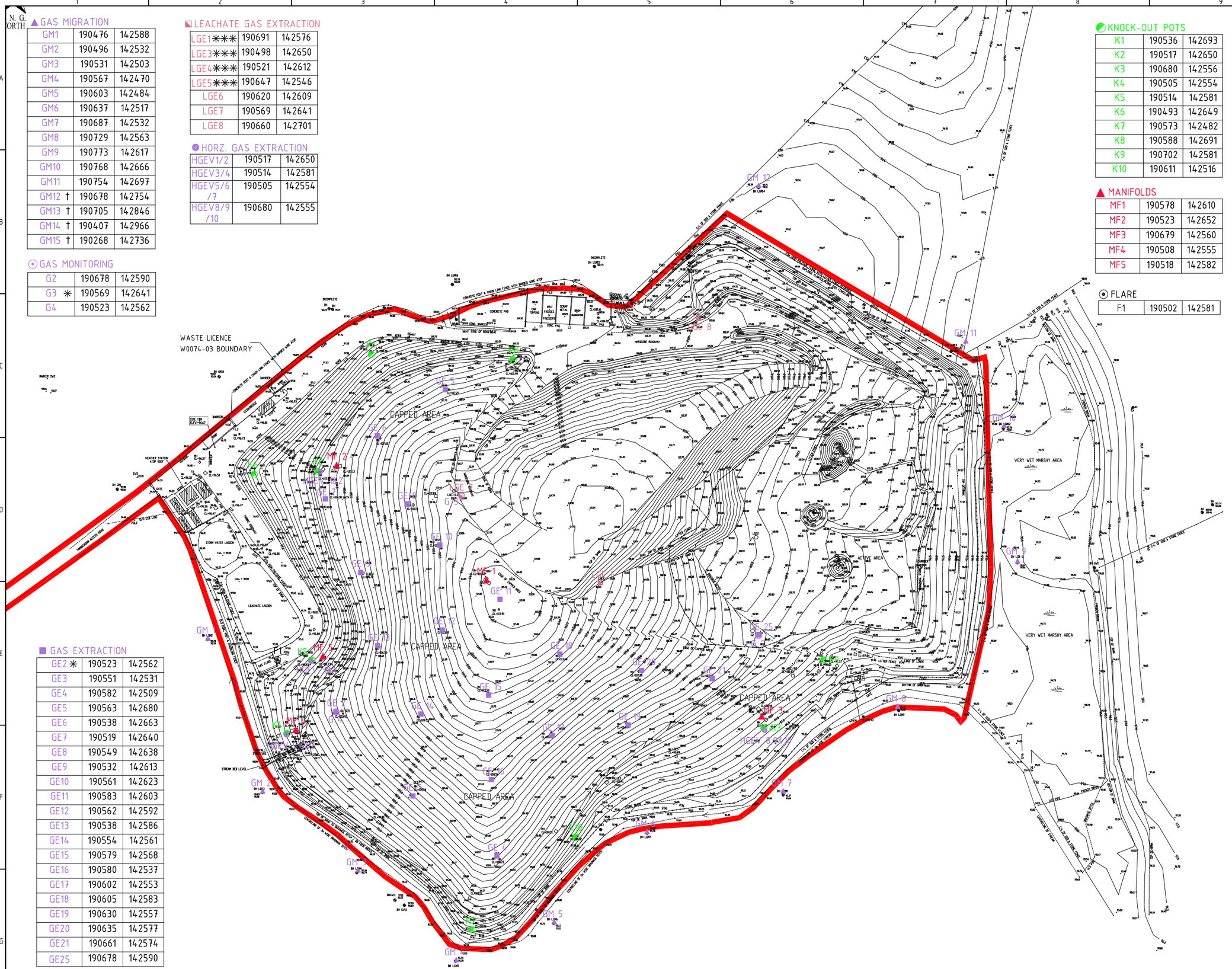
K1	190536	142693
K2	190517	142650
K3	190680	142556
K4	190505	142554
K5	190514	142581
K6	190493	142649
K7	190573	142482
K8	190588	142691
K9	190702	142581
K10	190611	142516

▲ MANIFOLDS

MF1	190578	142610
MF2	190523	142652
MF3	190679	142560
MF4	190508	142555
MF5	190518	142582

⊙ FLARE

F1	190502	142581



NOT FOR CONSTRUCTION UNLESS SPECIFICALLY STATED OTHERWISE

LEGEND :

Gas, Monitoring & Extraction Locations

- ▲ Gas Migration
- ⊙ Gas Monitoring
- ■ Gas Extraction
- ◪ Leachate Gas Extraction
- ● Horizontal Gas Extraction
- ◔ Knock-Out Pots
- ▲ Manifolds

NOTE :

† Denotes not shown on plan. Refer to DE07-024-04-Fig.001.

✳ Location moved since a previous revision.

✳✳ No pumps installed yet.

Background Survey Date 09.10.09

Rev.	Drawn	Chk'd	App'd	Date	Description
B	CBC	TR	BG	Cork 22.3.2010	ISSUE FOR AER 2009

Revision History: A | B

Name of Client

SOUTH TIPPERARY COUNTY COUNCIL

Name of Job

DONOHILL LANDFILL
LICENCE COMPLIANCE 2007

Title of Drawing

GAS MONITORING AND EXTRACTION LOCATIONS

Scales Used
NTS

Dwg. No. DE07-024-04-005 — **Rev.** B

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CONSULTANTS IN ENGINEERING & ENVIRONMENTAL SCIENCES
Core House, Pouladuff Rd, Cork, Ireland.
T:+353-21-4964133, F:+353-21-4964464
Mill House, Ashtown Gate, Navan Rd, Dublin 15, Ireland.
T:+353-1-6583500, F:+353-1-6583501
W: www.fehilytimoney.ie, E: info@ftco.ie

ORIGINAL DRAWING SIZE A1 - (841 x 594)

NATURAL SCALE 10 0 10 20 50 100mm

N. G.
ORTH

LEACHATE COMPOSITION

LC1	190496	142615
LC2	190496	142615
LC3 ***	190495	142584
LC4	190495	142600

LEACHATE LEVEL

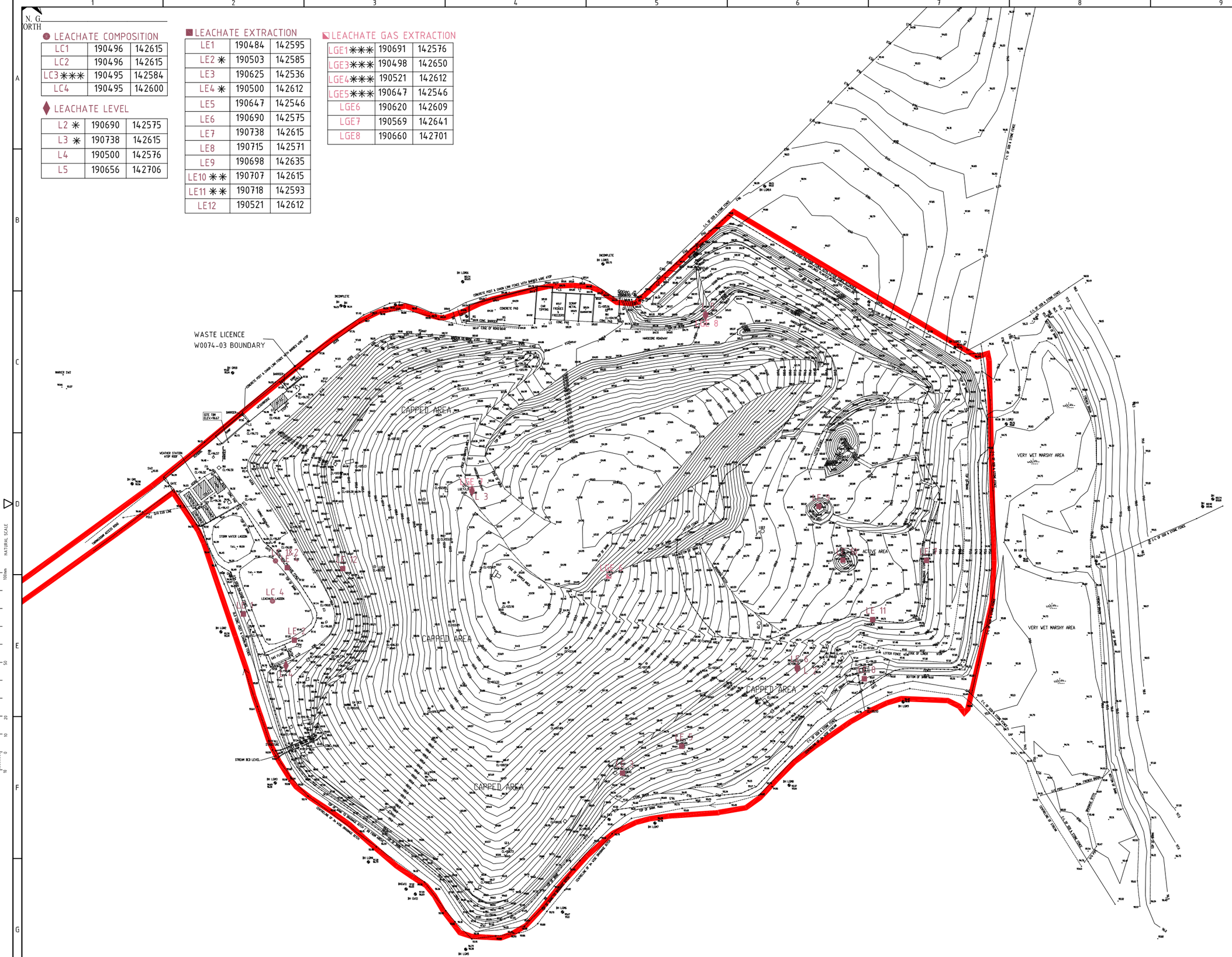
L2 *	190690	142575
L3 *	190738	142615
L4	190500	142576
L5	190656	142706

LEACHATE EXTRACTION

LE1	190484	142595
LE2 *	190503	142585
LE3	190625	142536
LE4 *	190500	142612
LE5	190647	142546
LE6	190690	142575
LE7	190738	142615
LE8	190715	142571
LE9	190698	142635
LE10 **	190707	142615
LE11 **	190718	142593
LE12	190521	142612

LEACHATE GAS EXTRACTION

LGE1***	190691	142576
LGE3***	190498	142650
LGE4***	190521	142612
LGE5***	190647	142546
LGE6	190620	142609
LGE7	190569	142641
LGE8	190660	142701



LEGEND :

Leachate Monitoring & Extraction Locations

- Leachate Composition
- Leachate Level
- Leachate Extraction
- Leachate Gas Extraction

* Location moved since a previous revision.

** No pumps installed yet.

*** Well not in use.

Background Survey Date 09.10.09

Rev.	Drawn	Chk'd	Appd	Date	Description
B	CBC	TR	BG	Cork 22.3.2010	ISSUE FOR AER 2009
Revision History	A	B			

Name of Client

SOUTH TIPPERARY
COUNTY COUNCIL

Name of Job

DONOHILL LANDFILL
LICENCE COMPLIANCE 2007

Title of Drawing

LEACHATE MONITORING AND
EXTRACTION LOCATIONS

Scales Used
NTS

Dwg. No.
DE07-024-04-006

Rev.
B

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ORIGINAL DRAWING SIZE A1 - (841 x 594)

NATURAL SCALE 10 0 10 20 50 100mm

AREA B
TEMPORARY CAP OF STEEP SLOPES

AREA D
TEMPORARY CAP, POZIDRAIN AND 1M CLAY

AREA A
PROPOSED EXTENT OF AREA 1/3 CAP

AREA 1 (UNLINED SECTION)

AREA 3 (FULLY LINED CELL)

EXISTING SURFACE WATER SWALE

FRENCH DRAIN

WASTE LICENCE
W0074-03 BOUNDARY

LEACHATE RISING MAIN

PHASE 1 CAPPING

50mm COMPRESSED AIR PIPE

OIL INTERCEPTOR

EXISTING OUTFALL STRUCTURE

AREA 2 (FULLY LINED CELL)

AREA C
TEMPORARY CAP

AREA 4
(CELL BOUNDARY)

160mm SLOTTED HDPE

160mm SOLID HDPE

STONE DRAIN

SECONDARY SURFACE WATER SWALE

50mm LEACHATE PIPE

ORIGINAL LEACHATE INTERCEPTOR TRENCH (2003)

EXISTING SURFACE WATER SWALE

SITE PLAN
Scale 1:1000

NOT FOR CONSTRUCTION UNLESS SPECIFICALLY STATED OTHERWISE

NOTE: This drawing is for indicative purposes only.

- Waste Licence W0074-03 Boundary
- Area 1 (Unlined Section) Boundary
- Area 2 (Fully Lined Cell) Boundary
- Area 3 (Fully Lined Cell) Boundary
- Area 4 (Fully Lined Cell) Boundary
- Phase 1 Cap Fully Lined Cap
- Area A Proposed Extent of 1/3 Cap
- Area B Temporary Cap of Steep Slopes
- Area C Temporary Cap
- Area D Temporary Cap, Pozidrain&1m Clay
- Existing Surface Water Swale
- Secondary Surface Water Swale
- French Drain
- Oil Interceptor
- RG Denotes Road Gully
- Overliner Gas Extraction Pipe 90mm HDPE PE100 SDR 17.6
- Overliner Gas Extraction Pipe 250mm HDPE PE100 SDR 17.6
- 50mm Compressed Air Pipe
- 50mm Leachate Pipe
- Leachate Rising Main
- Original Leachate Interceptor Trench (2003)

Refer to Drawing LW10-024-01-003 for details of monitoring points.

Rev.	Drawn	Chk'd	App'd	Date	Description
C				Cork 24.3.2010	ISSUE FOR INFORMATION

Revision History: A B C

Name of Client
SOUTH TIPPERARY
COUNTY COUNCIL

Name of Job
DONOHILL LANDFILL LICENCE
COMPLIANCE 2010

Title of Drawing
COMPOSITE MAP OF LANDFILL
FOR EPA

Scales Used	This Drawing was printed to
1:1000	A3

Dwg. No.	Rev.
LW10-024-01-004	C

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T:+353-21-4964133, F:+353-21-4964464
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ORIGINAL DRAWING SIZE A1 - (841 x 594)

▲ GAS MIGRATION

GM1	190476	142588
GM2	190496	142532
GM3	190531	142503
GM4	190567	142470
GM5	190603	142484
GM6	190637	142517
GM7	190687	142532
GM8	190729	142563
GM9	190773	142617
GM10	190768	142666
GM11	190754	142697
GM12 †	190678	142754
GM13 †	190705	142846
GM14 †	190407	142966
GM15 †	190268	142736

⊙ GAS MONITORING

G2	190678	142590
G3 ✳	190569	142641
G4	190523	142562

● LEACHATE COMPOSITION

LC1	190496	142615
LC2	190496	142615
LC3✳✳✳	190495	142584
LC4	190495	142600

◆ LEACHATE LEVEL

L2 ✳	190690	142575
L3 ✳	190738	142615
L4	190500	142576
L5	190656	142706

■ GAS EXTRACTION

GE2 ✳	190523	142562
GE3	190551	142531
GE4	190582	142509
GE5	190563	142680
GE6	190538	142663
GE7	190519	142640
GE8	190549	142638
GE9	190532	142613
GE10	190561	142623
GE11	190583	142603
GE12	190562	142592
GE13	190538	142586
GE14	190554	142561
GE15	190579	142568
GE16	190580	142537
GE17	190602	142553
GE18	190605	142583
GE19	190630	142557
GE20	190635	142577
GE21	190661	142574
GE25	190678	142590

■ LEACHATE EXTRACTION

LE1	190484	142595
LE2 ✳	190503	142585
LE3	190625	142536
LE4 ✳	190500	142612
LE5	190647	142546
LE6	190690	142575
LE7	190738	142615
LE8	190715	142571
LE9	190698	142635
LE10 ✳✳	190707	142615
LE11 ✳✳	190718	142593
LE12	190521	142612

◪ LEACHATE GAS EXTRACTION

LGE1✳✳✳	190691	142576
LGE3✳✳✳	190498	142650
LGE4✳✳✳	190521	142612
LGE5✳✳✳	190647	142546
LGE6	190620	142609
LGE7	190569	142641
LGE8	190660	142701

● HORZ. GAS EXTRACTION

HGEV1/2	190517	142650
HGEV3/4	190514	142581
HGEV5/6/7	190505	142554
HGEV8/9/10	190680	142555

◐ KNOCK-OUT POTS

K1	190536	142693
K2	190517	142650
K3	190680	142556
K4	190505	142554
K5	190514	142581
K6	190493	142649
K7	190573	142482
K8	190588	142691
K9	190702	142581
K10	190611	142516

▲ MANIFOLDS

MF1	190578	142610
MF2	190523	142652
MF3	190679	142560
MF4	190508	142555
MF5	190518	142582

⊙ FLARE

F1	190502	142581

⊙ GROUNDWATER

GW11S	190545	142493
GW11D	190548	142491
GW12S	190841	142635
GW12D	190845	142638
GW13 †	190700	142846
GW14 †	190412	142965
GW15 †	190286	142741
GW16 †	190070	144050

◬ SURFACE WATER

SW1	190754	142564
SW2	190461	142631
SW3 †	190695	142966
SW4 †	191390	140939
SW5	190481	142623
SW7	190508	142544
SW8	190626	142515

NOTE :

† Denotes not shown on plan. Refer to DE07-024-04-Fig.001.

✳ Location moved since a previous revision.

✳✳ No pumps installed yet.

✳✳✳ Well not in use.

Rev.	Drawn	Chk'd	App'd	Date	Description
A	CJC	TPC	CJC	11.03.10	ISSUE FOR APPROVAL

Revision History: A

Name of Client
SOUTH TIPPERARY COUNTY COUNCIL

Name of Job
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Title of Drawing
MONITORING TABLES FOR COMPOSITE MAP OF LANDFILL FOR EPA

Scales Used: N/A

This Drawing was printed to A3

Dwg. No.: LW10-024-01-003

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FEHILY TIMONEY & COMPANY
CONSULTANTS IN ENGINEERING & ENVIRONMENTAL SCIENCES
Core House, Pouladuff Rd, Cork, Ireland.
T:+353-21-4964133, F:+353-21-4964464
Mill House, Ashtown Gate, Navan Rd, Dublin 15, Ireland.
T:+353-1-6583500, F:+353-1-6583501
W: www.fehilytimoney.ie, E: info@ftco.ie

APPENDIX 2 FLARE EMISSIONS MONITORING REPORT

ODOUR & ENVIRONMENTAL ENGINEERING CONSULTANTS

Unit 32 De Granville Court, Dublin Rd, Trim, Co. Meath

Tel: +353 46 9437922
Mobile: +353 86 8550401
E-mail: info@odourireland.com
www.odourireland.com

AIR EMISSION TESTING OF A LANDFILL FLARE LOCATED IN DONOHILL LANDFILL, GARRYSHANE, DONOHILL, CO. TIPPERARY

PERFORMED BY ODOUR MONITORING IRELAND ON BEHALF OF TIPPERARY COUNTY COUNCIL

PREPARED BY:	Dr. John Casey
ATTENTION:	Ms. Louise Ryan
REFERENCE:	Waste licence W0074-02
DATE:	06th Jan. 2010
REPORT NUMBER:	2010A8(1)
REVIEWERS:	

TABLE OF CONTENTS

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1. Introduction

This report has been prepared by Odour Monitoring Ireland and contains the results of emission testing carried out on 1 No. Enclosed ground flare at Donohill Landfill, Garryshane, Donohill, Co. Tipperary. The emission testing was carried out in compliance with the requirements of *Waste licence W0074-02*.

Odour Monitoring Ireland was requested by Ms. Louise Ryan, Landfill Manager, Donohill Landfill to perform emission testing of the 1 flare stack located within Donohill Landfill, Garryshane, Donohill, Co. Tipperary. The parameters listed in *Table 1.1* were monitored using the appropriate instrumentation as illustrated in *Table 1.1*.

Table 1.1. Monitored parameters and techniques for Donohill Landfill 1 No. Enclosed flare

Sample location	Parameter	Analytical method
1 Landfill Flare outlet	Volumetric airflow rate & Temperature (^{0}C)	Pitot in accordance with EN13284-1 and K type thermocouple and PT100 Theoretical calculated for Landfill flare
1 Landfill Flare outlet	Oxides of nitrogen (NO_X), Carbon monoxide (CO), Carbon dioxide (CO_2), Sulphur dioxide (SO_2), and Oxygen (O_2)	Flue gas analyser, Testo 350/454 MXL
1 Landfill Flare outlet	Total non methane VOC's (TOC)	Total non methane hydrocarbon cutter in conjunction with Portable Signal 3030 PM Heated FID

This report presents details of this monitoring programme. This environmental monitoring was carried out by Dr. John Casey, Odour Monitoring Ireland on the 10th December 2009. Methodology, Results, Discussion and Conclusions are presented herein.

2. Materials and Methods

This section provides brief details of the methodology employed to perform emission testing of the landfill flare stack located in Donohill Landfill, Garryshane, Donohill, Co. Tipperary.

2.1 Volumetric flow rate and temperature measurement

The volumetric flow rate of the landfill flare was determined from theoretically calculated total volumetric flow rates using the assumptions presented in *Appendix II*. The inlet landfill gas velocity measurements were calculated from the CEMS monitoring system within the landfill flare control building. Temperature traverse measurements were performed across the stack in one plane only. Only one plane was possible due to access port issues. A magnesium oxide K type and PT100 thermocouple was used for measuring temperature in the landfill flare.

2.2 In stack analysis for flue gases

Flue gas analysis was performed using a pre-calibrated Testo 350 MXL/454 flue gas analyser. Concentrations of Oxygen, Sulphur dioxide, Carbon dioxide, Temperature, Carbon monoxide and Oxides of nitrogen were measured using electrochemical cells within the analyser box and all data was logged electronically in 1 minute intervals during the sampling exercise. Data was downloaded from the control handheld using the Com soft software and average concentrations calculated are presented within. All results presented are at 273.15 K, 101.3 kPa on a dry gas basis.

2.3 Heated Flame Ionisation Detector-Total hydrocarbon concentration (THC) determination

A heated portable FID (Signal), heated line, controller and data logger was used to analyse the duct air stream for total hydrocarbon concentration. Once stabilised and calibrated using span gas (Propane-800 ppm; European standard), a sintered probe connected to a 181 ^{0}C heated line was placed in the air stream. After stabilisation, the data logger was activated and commences reading. The FID remained analysing continuously for approximately 45 minutes in the duct air stream. Results were presented as mg [THC] m^{-3} as propane. All measurement was performed in accordance with the methodologies contained within EN13526:2002 and EN12619:1999.

An FID operates on the principle where influent contaminated gas is mixed with hydrogen and the mixture is burned at the tip of a jet with air or oxygen. Ions and free electrons are formed in the flame and enter a gap between two electrodes, the flame jet and a collector, mounted 0.5-1.0 centimetres above the flame tip. A potential (400 volts) is applied across the two electrodes and with the help of produced ions, a very small current flows between the two electrodes. When an organic substance is introduced this is burned in the flame; a complex process takes place in which positively charged carbon species and electrons are formed. The current is greatly increased and therefore the sample is detected. The FID is a mass flow detector, its response depending directly on the flow rate of the carrier gas. Its response also varies with applied voltage and the temperature of the flame.

2.4 Total non-methane volatile organic compounds (TOC)

In order to measure total non-methane VOC, a total non-methane hydrocarbon cutter was placed in line with the FID whereby concentrations of total volatile organic carbon and total non-methane organic were displayed digitally upon the display. This allowed for the calculation of total non-methane VOC's. All results are presented in mgC/Nm^3 as propane which is in accordance with the EN13526:2002 and EN12619:1999.

3. Results-Emission testing.

3.1 Sampling time

Table 3.1 summarises the sampling time that was carried out on the individual stack. *Table 3.2* illustrates the inlet landfill gas parameters as characterised from the CEMS analyser system operating within the landfill flare control building. Additionally, manual monitoring was performed using a GA2000 landfill gas analyser.

All outlet gas samples were taken approximately 1.20 metres below the top of the stack for the landfill flare No.1. All sampling was performed through the existing 25mm sampling ports on the landfill flare. A one-plane oxygen and temperature traverse was performed to assess any difference in oxygen concentrations and temperature across the sampling plane. Temperature and Oxygen differences were less than the 15% deviation level as recommended by the UK Environmental Agency (Guidance for monitoring enclosed Landfill flares, 2002).

3.2 Volumetric flow rate results

Table 3.3 summarises the theoretical airflow rate calculations for the Landfill gas flare No. 1. *Table 3.3* includes the exhaust volumetric airflow rate expressed in $m^3\ hr^{-1}$ at both actual and standard reference conditions of 273.15 K, 101.3 kPa (i.e. standard temperature and pressure).

3.3 Flue gas concentration results

Flue gas concentrations were monitored using a pre-calibrated Testo 350/454 MXL flue gas analyser. The results of SO_2, NO_x as NO_2 + NO, CO, and O_2 are presented in *Table 3.4*. The results of ppm have been converted to mg Nm^{-3} at 273.15 K, 101.3 kPa, on a dry gas basis with correction for oxygen content. In accordance with EPA flare monitoring requirements, Oxygen correction to 3% should be performed for landfill gas flares. The average temperature of the gas analyser on the day of sampling was 280.15 K.

3.4 Total hydrocarbon concentration (THC) results

THC concentrations were monitored using a pre-calibrated Signal 3030PM analyser. The results of THC are presented in *Table 3.4*. The results of ppm have been converted to mg Nm^{-3} at 273.15 K, 101.3 kPa, with correction for oxygen content. Conversion from ppm to mg m^{-3} was performed using a 1.60 multiplication factor for propane. The average temperature of the FID on the day of sampling was 454 K.

3.5 Total non-methane volatile organic compound (TNMVOC) (TOC)

Total non-methane volatile organic compound (TNMVOC) concentrations were monitored using a total non methane hydrocarbon cutter. The results of TNMVOC's are presented in *Table 3.4*. The results are presented as mg/Nm^3 at 273.15 K, 101.3 kPa, with correction for oxygen content. In accordance with EPA flare monitoring requirements, Oxygen correction to 3% should be performed for landfill gas flares. The average temperature of the FID on the day of sampling was 454 K.

Table 3.1. Sampling time runs on the 10thDecember 2009.

Parameter	**Approx. Sampling period for 1 No. landfill flare**
Volumetric air flow rate	Theoretically calculated
SO_2	60 minutes
NO_x	60 minutes
CO	60 minutes
O_2	60 minutes
CO_2	60 minutes
Stack gas temp	60 minutes
THC	60 minutes
TNMVOC (TOC)	60 minutes

Table 3.2. Characteristics of raw inlet landfill gas to the 1 No. Enclosed Landfill flare gas burner.

Inlet compound identity	**Enclosed flare Unit**	**Unit values**
CH_4	29.50	%
CO_2	19.32	%
O_2	5.60	%
Total Landfill gas Volumetric airflow rate	210	m^3/hr

Table 3.3. Theoretically calculated landfill gas exhaust volume and physical characteristics from 1 No. Landfill flare.

Parameter	Enclosed flare Unit
Total Volumetric methane loading (m^3/hr)	61.95
Total Volumetric Oxygen loading (m^3/hr)	11.76
Ratio to complete combustion of methane assuming no excess Oxygen	9.57
Oxygen concentration level in flue gas (%)	9.88
Flue gas temperature (Kelvin)[1]	1,408
Theoretical Volumetric exhaust airflow rate (m^3/h)	1,500
Normalised average exhaust airflow rate (Nm^3/h)[2]	291

Notes: [1] denoted converted from degrees Celsius to Kelvin (^{0}C + 273.15);
[2] denotes normalised to 273.15 Kelvin and 101.3 kPa.

Table 3.4. Emission value results from the measurement of emissions from the landfill gas flare burner.

Flare – Compound identity	Value	Units	Adjusted units (mg/Nm^3)	Volumetric flow rate (Nm^3/hr)	Emission conc (mg/Nm^3)	Oxygen corrected emission conc to 3% (mg/Nm^3)	Mass emission rate (kg/hr)	Emission limits
CO	2	ppm	2.50	291	2.50	4.06	0.00073	<50 mg/m^3
Temperature	1135	degrees	1408K	291	-	-		>1000 K
O_2	9.88	%	-	291	-	-		-
Total NOx [as NO_2]	28	ppm	57.40	291	57.40	93.22	0.01670	<150 mg/m^3
SO_2	5	ppm	14.25	291	14.25	23.14	0.00415	-
CO_2	8.18	%	-	291	-	-		-
TOC/TNMVOC	2.55	ppm	4.08	291	4.08	6.63	0.00119	<10 mg/m^3
Inlet CH_4	2.11×10^5	ppm	2.11×10^5	61.95	-	-	13.054	-
Total VOC's as CH_4	4	ppm	6.40	291	6.40	10.39	0.00186	-
Volumetric airflow rate	291	Nm^3/hr	-	-	-	-	-	-
Total methane destruction efficiency	99	%	-	-	-	-	-	-

Notes: [1] denotes refer to *Appendix II* for Oxygen correction calculations.
[2] denotes units normalised to 3% O_2 for flare.

4. Discussion of results

Tables 3.1 to *3.4* present the results of the emission monitoring carried out on the landfill flare stack burner located in Donohill Landfill, Garryshane, Donohill, Co. Tipperary

There was very little variation at one traverse in oxygen and flue gas temperature profiles across the stack during the monitoring exercise (i.e. less than 15% as recommended by the Environment Agency, UK (Environment Agency, 2002)).

A high temperature Inconel 625 and ceramic probe (Testo, Germany) was used to prevent variations in CO emissions data. Normal stainless steel probes when subjected to temperatures above 600^0C can release CO from within the structure of the material and cause the recording of erroneous results (Environment Agency, 2002).

Correction of data to 3% oxygen was performed. Due to possible inaccuracies in airflow rate measurement, it was not possible to determine the oxygen intake of the flare through the louver system using measurement. Since the volume of intake air required for complete combustion was known and the oxygen concentration in the exhaust flue gas was known, the volume of intake excess fuel air could be manually and theoretically calculated through numerous iterations using the Solver program (i.e. Microsoft Excel). This allows for the calculation of the volume of intake excess air through the louver landfill flare intake system. These calculations were validated through use of the published Environment Agency equation (see *Eqn 8.3.1*) (Environment Agency, 2002).

Landfill methane destruction efficiency was calculated using the inlet methane loading concentration and the exhaust total methane hydrocarbon concentration as presented in *Table 3.4*. As can be observed, the landfill flares is achieving a methane destruction efficiency of greater than 99%. Typical reported concentrations of methane from landfill flare burner systems are in the order of 0.040% to 0.52%. The complete combustion of methane results in the formation of CO_2 and H_2O. The incomplete combustion of methane results in the formation of CO. CO concentration levels was low in the flue gas of the landfill flare.

5. Conclusion

The following conclusions can be drawn from this study:

1. A theoretically exhaust flue gas volume was calculated for landfill gas flare.
2. NO_x, SO_2, CO, O_2, and TOC monitoring and analysis was carried out in accordance with specified requirements;
3. All data was standardised to 273.15 Kelvin, 101.3 kPa;
4. All data is presented as Oxygen corrected to 3% (v/v) using the appropriate equations as presented in *Section 8.3*;
5. NO_x as NO_2, CO, and TOC were in compliance for the landfill gas flare exhaust stack and within the emission limit values contained within Waste licence W0074-02 – Schedule C4.

6. References

1. Environment Agency. (2002). Guidance for Monitoring Enclosed Landfill Gas Flares. www.environment-agency.co.uk
2. McVay, M., (2003). Personal communication. Environment Agency, Wales, UK.

7. *Appendix I* - Sampling, analysis and calculation details

7.1.1 Location of Sampling

Donohill Landfill, Garryshane, Donohill, Co. Tipperary

7.1.2 Date & Time of Sampling

11th Dec. 2009

7.1.3 Personnel Present During Sampling

Dr. John Casey, Odour Monitoring Ireland, Trim, Co. Meath.

7.1.4 Instrumentation

Testo 350 MXL/454 in stack analyser;
L type pitot and thermocouples;
Testo 400 handheld and appropriate probes.
Ceramic and Inconel 625 sampling probes.
Portable Signal 3030PM FID calibrated with Propane
Model 320A non-methane total hydrocarbon cutter

8. *Appendix II* - Example calculations and conversions

8.1 Conversion of 28 PPM Oxides of nitrogen to mg m^{-3} at 273.15 Kelvin and 101.3 kPa (STP) for landfill flare No. 1

1 mole of an ideal gas occupies 22.4 litres at standard temperature and pressure of 273.15 Kelvin[1] and 101.3 kPa (STP), where a mole of any substance is equal to its molecular mass and expressed in grams.

This is known as molar mass (i.e. the volume occupied by one gram mole of a gas at STP).

Using the average recorded concentration (in ppm) for NO_2 during the survey, the conversion is as follows:

1 mole of NO_2 occupies 22.4 litres @ STP

46 grams (Molecular weight of NO_2) occupies 22.4 litres @ STP

mg m^{-3} NO_2 = 28.00 ppm × 46 / 22.40 = 57.40 mg N m^{-3}

8.2 Additional calculations and correction of Oxygen concentration measured to reference Oxygen concentration of 3% (v/v) for 57.40 mg N m^{-3} of NO_X as NO_2 for landfill flare No. 1

If excess air is added to an enclosed landfill flare (i.e. to promote better combustion), measured flue gas emission concentration of non-combustion species will fall. Emission concentrations appear to be reducing, whilst in reality mass emission rates have remained constant (Environment Agency, 2002). Therefore, it is necessary to compare concentrations at a standard oxygen concentration.

The relationship between the measured oxygen concentration and measured emission species concentration is non-linear as oxygen from air is added or removed. For example, a halving of the flue gas oxygen content does not result in a doubling of the emission concentration. The oxygen concentration in the flue gases is a measure of the excess air over that required for theoretical complete combustion (i.e. stiochiometric air requirement). Therefore, the measured oxygen level is a measure of the dilution of the flue gases from the stoichiometric condition. The concentration of oxygen in dry air is 20.9% (v/v) and the proportion of excess air (X/V) can therefore be calculated from the following:

$$\frac{X}{V} = \frac{(O_2)_m}{(20.9 - (O_2)_m)} \quad \textbf{(Eqn 8.3.1)}$$

Where: X is the volume of excess air (m^3);
V is the stoichiometric volume of the flue gas (m^3);
$(O_2)_m$ is the percentage of oxygen (v/v) in the flue gas (on a dry basis).

If we know and calculate the following:

The volume of landfill gas was 210 m^3 hr^{-1} with a methane and oxygen concentration of 29.50% (v/v) and 5.60%(v/v) as taken from the landfill gas analyser.

This equates to a methane and oxygen volume of 61.95 m^3 hr^{-1} and 11.76 m^3 hr^{-1}, respectively.

The stiochiometric ratio of oxygen to methane for combustion is **2:1** as shown below:

$$\mathbf{1}CH_4 + \mathbf{2}O_2 + 7.52\ N_2 \longrightarrow CO_2 + 2H_2O + 7.52\ N_2 + \text{Heat} + \text{Light}$$

Ambient air contains 20.9% (v/v) oxygen, therefore stiochiometric volume ratio of air required for complete combustion of methane is **9.57 times** methane volume.

Since the volume of oxygen in inlet landfill gas and stiochiometric ratio required is known, the total amount of intake air required for complete combustion is:

$$(61.95\ m^3\ h^{-1} \times 9.57) - 11.76\ m^3\ hr^{-1} = \mathbf{581\ m^3\ hr^{-1}}.\ \textbf{(Eqn 8.3.2)}$$

Therefore the total volume of flue gases exhausted through stack assuming total combustion and 0% (v/v) oxygen in flue gas is:

Volume of landfill gas + Volume of Inlet air = Total Volume of flue gas

210 m^3 hr^{-1} + 581m^3 hr^{-1} = **791 m^3 hr^{-1} (Eqn 8.3.3)**

In reality excess inlet air is taken into the landfill flare gas burner to ensure this combustion.

The measured oxygen concentration within the flue gas of the landfill flare in the landfill was **9.88% (v/v)** dry gas basis.

Therefore excess amounts of inlet air are being taken in through the louver system. As the airflow rate measurement may be highly inaccurate a back calculation method is used to calculate the amount of excess air taken into the flare burner using known combustion volume and flue gas Oxygen concentration % (v/v). This is shown below:

The following units are known:

- Volume of flue gas assuming total combustion and 0% (v/v) oxygen in flue gas outlet $V_{Flue\ gas}$ = 791 m^3 hr^{-1};
- Volume of measured excess Oxygen % (v/v) in flue gas outlet $(O_2)_{outlet}$ = 9.88% (v/v);
- Volume of excess inlet air to increase flue gas to measured Oxygen % (v/v) concentration V_{inlet} = unknown
- Oxygen concentration in inlet air $(O_2)_{inlet}$ = 20.90% (v/v)

Using a back calculation formula, and numerous iterations using Solver formula equation in Microsoft Excel, the volume of excess air added to the landfill flare burner system is V_{inlet} = 709 m^3 hr^{-1} which equates to a total excess Oxygen volume $(O_2)_{volume}$ = 148 m^3 hr^{-1}. Based on this, the calculated total volume of flue gas from the landfill flare would be 1,500 m^3 hr^{-1}.

The following simple equation illustrates validation of the assumptions used and calculated:

$$\%O_{2Outlet} = \left(\frac{O_{2volume}}{V_{Fluegas} + V_{inlet}}\right) \times 100 \quad \textbf{(Eqn 8.3.4)}$$

Referring back to *Equation 8.3.1*, the percentage proportion of excess air can then be calculated as below:

$$\left(\frac{731}{816} = \frac{9.88}{20.90 - 9.88}\right) \times 100 \quad \textbf{(Eqn 8.3.5)}$$

Therefore the percentage proportion of excess air over required fuel air is 89%. *Equation 8.3.5* could also be used to calculate the volume of excess air.

Since the volume of excess air into the landfill flare burner is known, then the ratio of overall intake air over intake landfill gas can be calculated:

$$Ratio_{air} = \frac{709 m^3 hr^{-1}}{210 m3/hr} \quad \textbf{(Eqn 8.3.6)}$$

Therefore $Ratio_{air}$ = 3.40 which can be expressed as **1:3.40**. This is a common occurrence in landfill flare burners although a value closer to 9 is more frequent.

For oxygen correction, the following calculation can be performed:

$$C_r = C_m \times \frac{(20.9 - (O_2)_r)}{(20.9 - (O_2)_m)} \text{ (Eqn 8.3.7)}$$

Where: C_r = referenced concentration;
C_m= measured concentration;
$(O_2)_r$ = reference oxygen concentration (3% (v/v) for Landfill flare burners);
$(O_2)_m$ = measured oxygen concentration in flue gas (9.88% (v/v)).

Hence the equation can be written as follows:

$$C_r = C_m \times \frac{17.9\%}{11.02\%} = C_r = C_m \times 1.62 \text{ (Eqn 8.3.8)}$$

For a NO_X as NO_2 concentration of 57.5 mg Nm^{-3} then the oxygen corrected value (3% (v/v)) would be as follows:

$C_r = 57.40 \times 1.62$ **= 93.20 mg N m^{-3} at referenced to 3% oxygen (v/v) dry gas**

APPENDIX 3 LANDFILL GAS MONITORING RESULTS

Sample Pt	Sam Date	CH4	CO2	O2	Pressure
GM 01	29/01/2009	0	0.1	20.2	
GM 01	27/02/2009				
GM 01	30/03/2009	0	0	20.3	1007
GM 01	29/04/2009	0	0	20.4	
GM 01	29/05/2009	0	0.1	20.4	
GM 01	30/06/2009	0.2	0	20.3	1005
GM 01	23/07/2009	0.2	0.1	20.4	999
GM 01	31/08/2009	0.1	0.1	20.2	989
GM 01	30/09/2009	0	0	20.2	1006
GM 01	29/10/2009	0	0	20.2	999
GM 01	30/11/2009	0	0.1	20.3	1002
GM 01	21/12/2009	0	0.1	20.2	976
GM 02	29/01/2009	0	0.2	20.1	
GM 02	27/02/2009	0	0.2	20.1	1007
GM 02	30/03/2009	0	0.1	20.2	1007
GM 02	29/04/2009	0	0.1	20.3	
GM 02	29/05/2009	0	0.2	20.4	
GM 02	30/06/2009	0.2	0.6	20	1006
GM 02	23/07/2009	0.2	0.3	20.1	999
GM 02	31/08/2009	0.1	0.2	20	989
GM 02	30/09/2009	0	0.1	20.1	1006
GM 02	29/10/2009	0	0.2	20.3	999
GM 02	30/11/2009	0	0.3	20	1002
GM 02	21/12/2009	0	0.2	20.1	976
GM 03	29/01/2009	0	0.1	20.7	
GM 03	27/02/2009	0	0.5	20	1007
GM 03	30/03/2009	0	0.1	20.2	1006
GM 03	29/04/2009	0	0.2	20.3	
GM 03	29/05/2009	0	0	20.5	
GM 03	30/06/2009	0.2	0.8	19.8	1006
GM 03	23/07/2009	0.2	0.6	20	999
GM 03	31/08/2009	0.1	0.4	19.7	989
GM 03	30/09/2009	0	0.2	20.4	1006
GM 03	29/10/2009	0	0.1	20.1	999
GM 03	30/11/2009	0	0.1	20.1	1002
GM 03	21/12/2009	0	0.3	20.1	976
GM 04	29/01/2009	0	0.1	20.2	
GM 04	27/02/2009	0	0.1	20.2	1006
GM 04	30/03/2009	0	0.4	20	1006
GM 04	29/04/2009	0	0.1	20.5	
GM 04	29/05/2009	0	0	20.6	
GM 04	30/06/2009	0.2	0.2	20.4	1005
GM 04	23/07/2009	0.2	0.1	20.4	999
GM 04	31/08/2009	0.1	0.1	19.9	989
GM 04	30/09/2009	0	0	20.1	1006
GM 04	29/10/2009	0	0	20.2	999
GM 04	30/11/2009	0	0.1	20	1002
GM 04	21/12/2009	0	0.2	20.2	976

Sample Pt	Sam Date	CH4	CO2	O2	Pressure
GM 05	29/01/2009	0	0	20.4	
GM 05	27/02/2009				
GM 05	30/03/2009	0	0.2	20.1	1007
GM 05	29/04/2009	0	0.3	20.1	
GM 05	29/05/2009	0	0.2	20.7	
GM 05	30/06/2009	0.2	0.4	20.1	1006
GM 05	23/07/2009	0.2	0.2	20.3	999
GM 05	31/08/2009	0.1	0.3	19.8	989
GM 05	30/09/2009	0	0.2	20.2	1006
GM 05	29/10/2009	0	0	20.5	999
GM 05	30/11/2009	0	0	20.2	1002
GM 05	21/12/2009	0	0.1	20.4	976
GM 06	29/01/2009	0	0	20.5	
GM 06	27/02/2009	0	0.4	19.9	1006
GM 06	30/03/2009	0	0	20.1	1007
GM 06	29/04/2009	0	0	20.2	
GM 06	29/05/2009	0	0.3	20.3	
GM 06	30/06/2009	0.2	0.3	20.1	1006
GM 06	23/07/2009	0.2	0.1	20.1	999
GM 06	31/08/2009	0.1	0.2	20.1	989
GM 06	30/09/2009	0	0.2	20.2	1006
GM 06	29/10/2009	0	0.1	20.4	999
GM 06	30/11/2009	0	0.2	20.1	1002
GM 06	21/12/2009	0	0	20.2	976
GM 07	29/01/2009	0	0	20.6	
GM 07	27/02/2009				
GM 07	30/03/2009	0	0.1	20.2	1007
GM 07	29/04/2009	0	0.1	20.3	
GM 07	29/05/2009	0	0.2	20.4	
GM 07	30/06/2009	0.2	0	20.2	1006
GM 07	23/07/2009	0.2	0.3	20.2	999
GM 07	31/08/2009	0.1	0.1	20.1	989
GM 07	30/09/2009	0	0.1	20.2	1006
GM 07	29/10/2009	0	0.1	20.2	999
GM 07	30/11/2009	0	0.1	20.2	1002
GM 07	21/12/2009	0	0.1	20.1	976
GM 08	29/01/2009	0	0.1	20.6	
GM 08	27/02/2009	0	0.1	20.1	1005
GM 08	30/03/2009	0	0.1	20.3	1007
GM 08	29/04/2009	0	0.3	20.3	
GM 08	29/05/2009	0	0.1	20.5	
GM 08	30/06/2009	0.2	0.2	20.1	1006
GM 08	23/07/2009	0.2	0	20.3	999
GM 08	31/08/2009	0.1	0.1	20	989
GM 08	30/09/2009	0	0	20.3	1006
GM 08	29/10/2009	0	0	20.4	999
GM 08	30/11/2009	0	0.1	20.2	1002
GM 08	21/12/2009	0	0.2	20.1	976

Sample Pt	Sam Date	CH4	CO2	O2	Pressure
GM 09	29/01/2009	0	0.1	20.5	
GM 09	27/02/2009				
GM 09	30/03/2009	0	0.2	20.1	1007
GM 09	29/04/2009	0	0.2	20.1	
GM 09	29/05/2009	0	0.1	20.5	
GM 09	30/06/2009	0.2	0.1	20.2	1006
GM 09	23/07/2009	0.2	0.1	20.3	999
GM 09	31/08/2009	0.1	0.9	19.3	988
GM 09	30/09/2009	0	0.3	20	1006
GM 09	29/10/2009	0	0.2	20.1	999
GM 09	30/11/2009	0	0.3	20.3	1002
GM 09	21/12/2009	0	0.2	20.1	976
GM 10	29/01/2009	0	0.3	20.6	
GM 10	27/02/2009				
GM 10	30/03/2009	0	0.3	20	1007
GM 10	29/04/2009	0	0.2	20.2	
GM 10	29/05/2009	0	0.2	20.6	
GM 10	30/06/2009	0.2	0.2	20.1	1006
GM 10	23/07/2009	0.2	0.1	20.1	999
GM 10	31/08/2009				
GM 10	30/09/2009	0	0.2	19.8	1006
GM 10	29/10/2009	0	0.1	20.3	999
GM 10	30/11/2009	0	0.2	20.2	1002
GM 10	21/12/2009				
GM 11	29/01/2009	0	0.1	20.7	
GM 11	27/02/2009	0	0.2	20.1	1005
GM 11	30/03/2009	0	0.1	20.1	1007
GM 11	29/04/2009	0	0.1	20.2	
GM 11	29/05/2009	0	0.1	20.5	
GM 11	30/06/2009	0.2	0.2	20	1006
GM 11	23/07/2009	0.2	0	20.2	999
GM 11	31/08/2009	0.2	1.3	17.7	988
GM 11	30/09/2009	0.1	1.1	17.9	1006
GM 11	29/10/2009	0	0.4	20	999
GM 11	30/11/2009	0	0.6	19.8	1002
GM 11	21/12/2009	0	0.1	20.2	977
GM 12	29/01/2009	0.5	0.7	19.3	
GM 12	27/02/2009	1.5	2.3	17.7	1005
GM 12	30/03/2009	0.7	1.1	18.9	1007
GM 12	29/04/2009	0.4	0.8	20.7	
GM 12	29/05/2009	0.9	1.2	19.9	
GM 12	30/06/2009	0.9	1.3	18.2	1006
GM 12	23/07/2009	0.7	1.1	17.2	999
GM 12	31/08/2009	0.6	0.5	19.4	989
GM 12	30/09/2009	0.5	0.5	18.2	1006
GM 12	29/10/2009	0.7	1.2	20	999
GM 12	30/11/2009	0.9	1.4	18.1	1002
GM 12	21/12/2009	0.6	0.7	19.6	977

Sample Pt	Sam Date	CH4	CO2	O2	Pressure
GM 13	29/01/2009	0	0.2	20.4	
GM 13	27/02/2009	0	0.2	20	1006
GM 13	30/03/2009	0	0.2	20.2	1007
GM 13	29/04/2009	0	0.1	20.2	
GM 13	29/05/2009	0	0	20.6	
GM 13	30/06/2009	0.2	0.6	19.5	1006
GM 13	23/07/2009	0.2	0.7	19.6	999
GM 13	31/08/2009	0.1	0.1	19.7	990
GM 13	30/09/2009	0	0	20.1	1006
GM 13	29/10/2009	0	0.2	20	999
GM 13	30/11/2009	0	0.3	19.7	1002
GM 13	21/12/2009	0	0.2	20.2	978
GM 14	29/01/2009	0	0	20.5	
GM 14	27/02/2009	0	0	20.2	1008
GM 14	30/03/2009	0	0	20.1	1007
GM 14	29/04/2009	0	0	20.4	
GM 14	29/05/2009	0	0	20.5	
GM 14	30/06/2009	0.2	0.9	18.7	1006
GM 14	23/07/2009	0.2	0.6	19.1	998
GM 14	31/08/2009	0.1	0.6	20	988
GM 14	30/09/2009	0	0.4	20	1005
GM 14	29/10/2009	0	0.3	19.9	999
GM 14	30/11/2009	0.1	0.7	18	1002
GM 14	21/12/2009	0	0.3	20	976
GM 15	29/01/2009	0	0	20.4	
GM 15	27/02/2009	0	0.8	19.1	1008
GM 15	30/03/2009	0	0.4	19.6	1007
GM 15	29/04/2009	0	0.1	20.3	
GM 15	29/05/2009	0	0.2	20.4	
GM 15	30/06/2009	0.2	0.9	19.2	1007
GM 15	23/07/2009	0.2	0.9	18.7	998
GM 15	31/08/2009	0.1	0.7	19.8	988
GM 15	30/09/2009	0	0.8	19.4	1005
GM 15	29/10/2009	0.1	0.6	19.8	998
GM 15	30/11/2009	0.2	1	19.1	1002
GM 15	21/12/2009	0	0.1	20.1	976

2009

Time/Date	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	Channel 9	Channel 10	Channel 11	Channel 12	Channel 13	Channel 14	Channel 15
01/01/2009 00:36	2.4	0.8	0.9	0	0	0	0	0.2	0.3	2.2	21.8	21.8	21.3	21.6	21.6
01/01/2009 12:36	1.7	-0.4	-0.1	0	0	0.1	0.1	0.2	0.7	2	21.8	21.8	21.1	21.7	21.6
02/01/2009 00:36	2.7	0.6	1.1	0	0	0.1	0	0.2	0.4	2.4	21.8	21.8	21.2	21.7	21.5
02/01/2009 12:36	-0.3	0	1.2	0	0	0.1	0	0.2	0.3	2.3	21.8	21.8	21.2	21.7	21.7
03/01/2009 00:36	2.7	0.2	3.8	0	0	0.1	0.1	0.2	0.7	1.9	21.8	21.8	21.3	21.6	21.7
03/01/2009 12:36	1.8	0	0.9	0	0	0.1	0	0.2	0.4	2.3	21.9	21.7	21.2	21.7	21.7
04/01/2009 00:36	2.7	0.4	0.5	0	0	0	0	0.2	0.2	2.1	21.8	21.8	21.2	21.7	21.6
04/01/2009 12:36	1.4	-0.2	-0.7	0	0	0.1	0	0.2	0.3	2	21.8	21.7	21	21.7	21.7
05/01/2009 00:36	2.8	0.7	0.8	0	0	0.1	0	0.2	0.5	2	21.8	21.8	21.2	21.6	21.5
05/01/2009 12:36	-0.3	-0.5	1	0	0	0.1	0	0.2	0.5	1.9	21.8	21.7	21.2	21.7	21.4
06/01/2009 00:36	0	0.3	3.8	0	0	0.1	0.1	0.2	0.6	1.9	21.8	21.8	21.3	21.7	21.5
06/01/2009 12:37	-0.7	-1	0.2	0	0	0.1	0.1	0.2	0.3	2.1	21.7	21.8	21.2	21.7	21.3
07/01/2009 00:37	3.4	0.8	4.6	0	0.1	0.2	0.1	0.2	0.1	1.8	21.8	21.8	21.3	21.6	21.3
07/01/2009 12:37	-0.4	-0.5	-0.1	0	0	0.1	0.1	0.3	0.7	2.3	21.7	21.8	21	21.7	21.6
08/01/2009 00:37	3.1	0.7	4.4	0	0.1	0.2	0.1	0.3	0.6	2.1	21.8	21.8	21.3	21.7	21.4
08/01/2009 12:37	-0.4	-0.8	0.4	0	0	0.1	0.1	0.3	0.5	2.1	21.7	21.8	21.1	21.7	21.6
09/01/2009 00:37	2.3	0.9	4.1	0	0	0.1	0	0.2	0.3	1.9	21.8	21.8	21.3	21.7	21.6
09/01/2009 12:37	-0.3	-0.6	0.8	0	0	0.1	0.1	0.3	0.6	2.5	21.7	21.7	21.1	21.6	21.5
10/01/2009 00:37	2.8	1	4.2	0	0	0.1	0	0.3	0.8	2.6	21.8	21.8	21.3	21.7	21.3
10/01/2009 12:37	1.8	0.2	2.2	0	0	0.1	0	0.4	0.8	3.1	21.8	21.8	21.2	21.6	21.3
11/01/2009 00:37	2.7	1.5	3.7	0	0	0.1	0	0.3	0.8	2.6	21.8	21.7	21.3	21.6	21.4
11/01/2009 12:37	2	1.4	2.8	0	0	0	0	0.2	1.2	2.7	21.8	21.7	21.2	21.6	21.6
12/01/2009 00:37	2.8	1.7	4	0	0	0.1	0	0.2	0.7	2.6	21.8	21.7	21.2	21.6	21.4
12/01/2009 12:37	1	0.7	2.6	0	0	0.1	0	0.1	0.8	2.6	21.7	21.6	21.2	21.6	21.5
13/01/2009 00:37	2.8	1.6	3.8	0	0	0.1	0	0.1	0.8	2.1	21.8	21.7	21.3	21.6	21.6
13/01/2009 12:37	1.2	0.2	1.4	0	0	0.1	0	0.1	1.1	2.2	21.8	21.6	21.1	21.6	21.5
14/01/2009 00:37	0.8	0.9	4.3	0	0	0.1	0.1	0.2	0.6	2.4	21.8	21.8	21.3	21.6	21.6
14/01/2009 12:37	0.7	1	2.6	0	0	0.1	0	0.2	0.6	2.9	21.6	21.6	21.1	21.6	21.6
15/01/2009 00:37	3.3	2.2	4.5	0	0	0.1	0	0.1	1	2.6	21.7	21.7	21.2	21.6	21.6
15/01/2009 12:37	1.7	1	2.9	0	0	0.1	0	0.1	0.6	2.3	21.7	21.6	21.2	21.6	21.6
16/01/2009 00:37	0.6	1.4	4.1	0	0	0.1	0	0.1	1	2.4	21.7	21.7	21.3	21.6	21.6
16/01/2009 12:37	1.1	1.2	2.5	0	0	0.1	0	0.1	0.6	2.4	21.6	21.7	21.1	21.6	21.5
17/01/2009 00:37	3.3	1.9	4.4	0	0	0.1	0	0.2	0.7	2.6	21.8	21.7	21.3	21.6	21.6
17/01/2009 12:37	3.3	1.9	3	0	0	0.1	0	0.2	0.6	2.9	21.7	21.7	21.2	21.6	21.3
18/01/2009 01:59	4.5	3	2.1	0	0	0.1	0	0.2	0.8	2.6	21.8	21.7	21.2	21.6	21.2
18/01/2009 13:59	3.7	2.2	1.4	0	0	0	0	0.3	0.6	2.9	21.8	21.8	21.1	21.6	21.4
19/01/2009 01:59	4.9	3.1	2.5	0	0	0	0	0.3	0.8	2.9	21.8	21.7	21.1	21.6	21.3
19/01/2009 13:59	2.3	1.8	3	0	0	0.1	0	0.3	0.7	2.6	21.7	21.7	21.2	21.6	21.3

Time/Date	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	Channel 9	Channel 10	Channel 11	Channel 12	Channel 13	Channel 14	Channel 15
20/01/2009 02:00	4.2	2.8	2.5	0	0	0	0	0.3	0.6	2.9	21.8	21.7	21.2	21.6	21.4
20/01/2009 14:00	2	1.3	2.7	0	0	0.1	0	0.3	0.8	2.7	21.8	21.6	21.1	21.6	21.5
21/01/2009 02:00	2.4	2.5	2.1	0	0	0.1	0	0.3	1	2.5	21.8	21.8	21.2	21.6	21.4
21/01/2009 14:00	2.8	1.2	3.5	0	0	0.1	0	0.3	1	2.6	21.7	21.6	21.1	21.6	21.4
22/01/2009 02:00	3.4	2.8	4.2	0	0	0	0	0.2	0.9	3.1	21.7	21.7	21.2	21.5	21.4
22/01/2009 14:00	2.3	1	2.9	0	0	0.1	0	0.2	1	2.8	21.7	21.6	21.1	21.6	21.6
23/01/2009 02:00	3.9	2.8	4.5	0	0	0.1	0	0.1	1	3	21.7	21.7	21.2	21.6	21.6
23/01/2009 14:00	1.7	1.2	2.3	0	0	0.1	0	0.2	1.2	2.7	21.7	21.5	21.1	21.5	21.4
24/01/2009 02:00	4.4	2.3	5.1	0	0	0.1	0	0.2	1	3	21.8	21.7	21.2	21.6	21.4
24/01/2009 14:00	3.3	1.2	2.7	0	0	0.1	0	0.4	0.9	2.6	21.8	21.7	21.2	21.5	21.4
25/01/2009 02:00	4.9	3.4	4.8	0	0	0.1	0	0.3	1	3.2	21.7	21.7	21.2	21.5	21.4
25/01/2009 14:00	4.5	2.6	4.3	0	0	0.1	0	0.2	1.1	2.8	21.8	21.6	21.2	21.5	21.4
26/01/2009 02:00	4.2	2.4	4.2	0	0	0.1	0	0.2	0.9	2.9	21.8	21.7	21.3	21.6	21.5
26/01/2009 14:08	0.3	0.4	0.1	0	0	0.1	0	0.2	1	0.5	21.7	21.6	21.8	21.6	21.6
27/01/2009 02:08	1.9	1.4	2.2	0	0	0.1	0	0.2	0.6	0.4	21.8	21.7	22.1	21.6	21.3
27/01/2009 14:08	0.2	0.7	1.2	0	0	0.1	0	0.1	1.1	0.1	21.7	21.6	21.9	21.5	21.7
28/01/2009 02:08	2.4	1.5	2	0	0	0.1	0	0.2	0.7	0.7	21.8	21.7	22.1	21.6	21.4
28/01/2009 14:08	-1	0.5	-0.2	0	0	0.1	0.1	0.2	0.7	0.6	21.7	21.6	21.7	21.5	21.5
29/01/2009 02:08	2	1.6	2.2	0	0	0.1	0	0.1	0.8	0.3	21.8	21.7	22.1	21.6	21.5
29/01/2009 14:08	1.2	1.1	0.9	0	0	0.1	0	0.1	0.8	0.7	21.7	21.5	21.9	21.6	21.4
30/01/2009 02:08	1.9	1.8	0.6	0	0	0.1	0	0.2	1.3	0.4	21.7	21.6	21.8	21.5	21.4
30/01/2009 14:08	1.2	1.6	1.8	0	0	0.1	0	0.1	0.9	0.4	21.7	21.4	21.9	21.5	21.6
31/01/2009 02:08	2	1.7	2	0	0	0.1	0	0.3	0.9	1.1	21.8	21.6	22	21.5	21.3
31/01/2009 14:08	1.3	1.4	1.5	0	0	0.1	0	0.2	0.9	0.7	21.7	21.5	22	21.5	21.4
01/02/2009 02:08	2.1	1.3	2.3	0	0	0.1	0	0.2	1	0.3	21.8	21.6	22.1	21.6	21.4
01/02/2009 14:08	1.3	0.8	1.6	0	0	0.1	0	0.2	0.7	0.2	21.8	21.6	22.1	21.6	21.5
02/02/2009 02:08	2.5	1.3	2.4	0	0	0.1	0	0.2	0.6	0.4	21.8	21.6	22.1	21.6	21.5
02/02/2009 14:08	-0.3	0.9	0	0	0	0.1	0	0.3	0.9	0.3	21.8	21.6	22	21.6	21.6
03/02/2009 02:08	3.1	2.3	1.1	0	0	0.1	0	0.3	0.7	0.4	21.8	21.6	22	21.6	21.3
03/02/2009 14:08	0.1	1.5	1.9	0	0	0.1	0	0.2	1	0.7	21.8	21.4	21.9	21.6	21.4
04/02/2009 02:08	2.5	1.1	3.4	0	0	0.1	0	0.3	0.7	0.6	21.8	21.6	22.1	21.6	21.5
04/02/2009 14:09	0.4	1.1	1.4	0	0	0.1	0	0.2	0.5	0.3	21.7	21.5	21.9	21.6	21.5
05/02/2009 02:09	0.3	2.1	3.4	0	0	0.1	0	0.2	0.4	0.7	21.8	21.6	22.1	21.6	21.4
05/02/2009 14:09	0.1	1.2	0.3	0	0	0.1	0	0.2	0.9	0.5	21.7	21.4	21.9	21.5	21.5
06/02/2009 02:09	1.7	1.9	3.1	0	0	0.1	0	0.2	0.6	0.4	21.8	21.6	22.1	21.6	21.4
06/02/2009 14:09	-0.6	0.8	0.9	0	0	0.1	0	0.2	1.2	0.3	21.6	21.3	21.9	21.6	21.5
07/02/2009 02:09	1	2.1	2.8	0	0	0.1	0	0.3	1	0.6	21.8	21.6	22.1	21.6	21.2
07/02/2009 14:09	-1.2	0.4	0.5	0	0	0.1	0	0.2	0.8	0.8	21.7	21.5	22	21.6	21.6
08/02/2009 02:09	0.9	1.6	2.4	0	0	0.1	0	0.3	0.8	0.8	21.8	21.6	22.1	21.6	21.3
08/02/2009 14:09	-0.7	0.6	0.6	0	0	0.1	0	0.2	0.8	0.4	21.7	21.4	21.9	21.6	21.6

Time/Date	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	Channel 9	Channel 10	Channel 11	Channel 12	Channel 13	Channel 14	Channel 15
09/02/2009 02:09	1.1	1.8	2.6	0	0	0.1	0	0.2	1.1	1.1	21.8	21.6	22.1	21.6	21.6
09/02/2009 14:09	-0.3	1.3	1.5	0	0	0.1	0	0.2	0.8	0.5	21.7	21.5	22	21.6	21.5
10/02/2009 02:09	1.8	1.8	1	0	0	0.1	0	0.2	1	0.7	21.8	21.5	22	21.6	21.7
10/02/2009 14:09	-0.5	0.9	1	0	0	0.1	0	0.1	0.9	0.3	21.7	21.3	21.9	21.6	21.6
11/02/2009 05:02	0.9	1.8	2.2	0	0	0.1	0.1	0.2	0.6	0.6	21.8	21.5	22.1	21.6	21.5
11/02/2009 17:02	-0.1	0.7	0.9	0	0	0.1	0	0.1	0.5	0.6	21.8	21.5	22.1	21.6	21.7
12/02/2009 05:02	0.9	1.3	1.5	0	0	0.1	0	0.1	1	0.6	21.8	21.5	22.1	21.6	21.5
12/02/2009 17:02	-0.6	0.6	1.2	0	0	0.1	0	0.1	0.9	0.6	21.7	21.4	22	21.6	21.5
13/02/2009 05:02	0.5	0.8	1.3	0	0	0.1	0	0.1	0.7	0.5	21.8	21.4	22.1	21.6	21.8
13/02/2009 17:02	-0.3	1.1	1.1	0	0	0.1	0	0.1	0.7	0.9	21.7	21.4	22	21.6	21.5
14/02/2009 05:02	0.8	0.9	1.3	0	0	0.1	0	0.1	0.9	0.5	21.8	21.4	22.1	21.6	21.6
14/02/2009 17:02	-0.1	0.4	1	0	0	0.1	0	0.1	1	0.8	21.8	21.4	22	21.6	21.6
15/02/2009 05:02	1.1	1	1.2	0	0	0.1	0.1	0.1	0.5	0.4	21.8	21.4	22.1	21.6	21.5
15/02/2009 17:02	-0.1	0.8	0.8	0	0	0	0	0.1	1	0.7	21.8	21.3	22	21.6	21.3
16/02/2009 05:02	1.8	1.1	2	0	0	0.1	0.1	0.1	0.9	0.5	21.8	21.4	22.1	21.6	21.5
16/02/2009 17:02	-0.8	0.7	1.6	0	0	0.1	0	0.1	1.1	0.4	21.7	21.3	22.1	21.6	21.6
17/02/2009 05:02	0.5	0.7	0.7	0	0	0.1	0	0.1	1.1	0.7	21.8	21.3	22.1	21.6	21.7
17/02/2009 17:02	-1	0.5	1.4	0	0	0.1	0	0.1	0.8	0.5	21.7	21.2	22.1	21.6	21.5
18/02/2009 05:02	0.9	0.9	1.1	0	0	0.1	0	0.1	1.3	0.6	21.8	21.3	22	21.6	21.6
18/02/2009 17:02	-1	0.7	1.8	0	0	0.1	0	0.1	0.6	0.6	21.7	21.2	22.1	21.6	21.6
19/02/2009 05:02	1	1.1	1.1	0	0	0.1	0	0.1	0.6	0.7	21.8	21.2	22.1	21.6	21.6
19/02/2009 17:02	0	0.9	1.1	0	0	0.1	0	0.1	0.9	0.5	21.8	21.1	22	21.6	21.6
20/02/2009 05:02	1.9	1.1	1.8	0	0	0.1	0.1	0.1	0.5	0.6	21.8	21.2	22.1	21.6	21.7
20/02/2009 17:02	-0.4	0.5	0.6	0	0	0.1	0	0.1	0.9	0.5	21.8	21	22	21.6	21.5
21/02/2009 05:02	1.9	1.1	2.5	0	0	0.1	0.1	0.1	0.8	0.6	21.8	21.1	22.1	21.6	21.5
21/02/2009 17:02	-0.1	0.1	1.1	0	0	0.1	0	0.1	1	0.7	21.8	20.9	22.1	21.6	21.6
22/02/2009 05:02	0.7	1.1	1.4	0	0	0.1	0	0.1	1.1	0.7	21.8	20.9	22.1	21.6	21.7
22/02/2009 17:02	0.5	0.2	1	0	0	0	0	0.1	0.8	0.6	21.8	20.7	22	21.6	21.5
23/02/2009 05:03	0.9	0.7	1.3	0	0	0	0	0.1	1	0.7	21.8	20.8	22	21.6	21.5
23/02/2009 17:03	-0.8	0.6	1.4	0	0	0	0	0.1	1.2	0.6	21.8	20.6	22	21.6	21.6
24/02/2009 05:03	1.1	1.4	1.3	0	0	0.1	0	0.1	1.2	0.6	21.8	20.5	22	21.6	21.5
24/02/2009 21:34	1	1.3	1.9	0	0	0.1	0	0.2	1	0.8	21.8	20.2	22.1	21.6	21.4
25/02/2009 09:34	1	0.9	1.1	0	0	0.1	0	0.1	1.1	0.6	21.7	20.1	21.9	21.6	21.6
25/02/2009 21:34	1.8	0.8	1.8	0	0	0.1	0	0.1	0.7	0.9	21.8	20.1	22.1	21.6	21.6
26/02/2009 09:35	1.7	0.9	1.2	0	0	0.1	0	0.1	1.1	1	21.8	20	21.9	21.6	21.5
26/02/2009 21:35	1	1.2	2	0	0	0.1	0	0.1	1.1	0.8	21.8	20	22	21.6	21.3
27/02/2009 09:35	1.1	1	1.2	0	0	0.1	0	0.1	1.1	0.8	21.7	19.9	21.9	21.6	21.6
27/02/2009 21:35	1.5	1.2	2.2	0	0	0.1	0	0.1	0.9	1.2	21.8	19.9	22	21.6	21.5
28/02/2009 09:35	1.5	1.4	1.5	0	0	0.1	0	0.1	1	1.3	21.7	19.8	22	21.5	21.5
28/02/2009 21:35	1.9	1.6	2.4	0	0	0.1	0	0.1	1.4	1.3	21.8	19.8	22	21.5	21.5

Time/Date	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	Channel 9	Channel 10	Channel 11	Channel 12	Channel 13	Channel 14	Channel 15
01/03/2009 09:35	2	1.2	1.6	0	0	0.1	0	0.1	1	1.1	21.8	19.7	22	21.6	21.5
01/03/2009 21:35	1.8	1.3	2.3	0	0	0.1	0	0.1	1.1	1	21.8	20.2	22	21.6	21.6
02/03/2009 09:35	1.6	1.3	2.3	0	0	0.1	0	0.1	0.9	1.2	21.8	20.1	22	21.6	21.3
02/03/2009 21:35	0.9	1.2	2.6	0	0	0.1	0	0.1	1.2	1.1	21.8	20.1	22.1	21.6	21.6
03/03/2009 09:35	1.7	1.7	3.4	0	0	0.1	0	0.1	1.1	1.4	21.7	20	22	21.6	21.2
03/03/2009 21:35	2.2	2.1	3.7	0	0	0.1	0	0.2	1.3	1.3	21.7	20	22	21.6	21.4
04/03/2009 09:35	2.3	2.2	2.9	0	0	0.1	0	0.2	0.9	0.8	21.7	20	22	21.6	21.4
04/03/2009 21:35	3	2.2	3.4	0	0	0.1	0	0.1	0.8	0.8	21.8	20	22	21.6	21.4
05/03/2009 09:35	2.7	2.2	1.7	0	0	0.1	0	0.2	0.9	0.9	21.7	19.9	21.9	21.6	21.5
05/03/2009 21:35	2.5	1.4	2.6	0	0	0.1	0	0.1	0.7	1	21.8	19.7	22.1	21.6	21.6
06/03/2009 09:35	2.7	1.4	1.9	0	0	0.1	0	0.1	0.7	0.7	21.7	19.6	22	21.6	21.6
06/03/2009 21:35	2	1.4	2.4	0	0	0.1	0	0.1	0.8	1	21.8	19.5	22.1	21.6	21.5
07/03/2009 09:35	2.1	1.7	2.3	0	0	0.1	0	0.1	1.1	1.4	21.8	19.4	22	21.6	21.5
07/03/2009 21:35	2.5	1.8	2.6	0	0	0.1	0	0.1	1.3	1.3	21.8	19.2	22.1	21.5	21.6
08/03/2009 09:35	3.1	2.2	2.4	0	0	0.1	0	0.1	1.1	1.1	21.8	19.2	22	21.6	21.6
08/03/2009 21:35	3.1	1.6	3	0	0	0.1	0	0.2	0.9	0.9	21.8	19.2	22.1	21.6	21.6
09/03/2009 09:35	2.6	1.7	1.9	0	0	0.1	0.1	0.2	1	1.4	21.8	19.1	22	21.6	21.5
09/03/2009 21:35	2.3	1.7	2.9	0	0	0.1	0	0.2	1	1.4	21.8	19	22	21.6	21.5
10/03/2009 09:35	1.8	1.4	1.7	0	0	0.1	0	0.1	1	1.4	21.7	18.9	22	21.6	21.4
10/03/2009 21:35	1.3	1.5	1.7	0	0	0.1	0	0.1	1.3	1.4	21.8	18.9	22	21.5	21.5
11/03/2009 09:35	1.1	0.9	0.7	0	0	0	0	0.1	1.2	1.1	21.7	18.8	21.8	21.5	21.5
11/03/2009 21:35	1.7	1.7	2.1	0	0	0.1	0	0.2	1.3	1.3	21.7	18.8	22	21.5	21.4
12/03/2009 09:36	1.5	1.1	2.5	0	0	0.1	0	0.1	1.3	1.7	21.7	18.8	21.9	21.5	21.4
12/03/2009 21:36	1.1	0.7	1.9	0	0	0.1	0.1	0.1	1.3	1.6	21.7	18.7	22	21.5	21.6
13/03/2009 09:36	1.5	1.3	1.8	0	0	0.1	0	0.1	1.1	1.3	21.7	18.6	22	21.5	21.5
13/03/2009 21:36	2.2	1.4	2.5	0	0	0	0	0.2	1.1	1.9	21.8	18.5	22	21.5	21.4
14/03/2009 09:36	1.5	1.1	1	0	0	0.1	0	0.1	1.2	1.3	21.8	17.5	21.9	21.6	21.4
14/03/2009 21:36	1.5	0.6	1.8	0	0	0.1	0	0.1	1.3	0.8	21.8	17.5	22.1	21.6	21.6
15/03/2009 09:36	1.4	1	0.8	0	0	0.1	0	0.2	1	1.4	21.8	17.4	22	21.6	21.4
15/03/2009 21:36	1.1	0.9	1.8	0	0	0.1	0	0.1	1.1	1.2	21.8	17.5	22	21.6	21.6
16/03/2009 09:36	1.2	1	0.8	0	0	0.1	0	0.2	1.2	1.7	21.8	17.4	21.9	21.6	21.4
16/03/2009 21:36	0.9	0.4	1.5	0	0	0.1	0	0.1	1.3	1.1	21.8	17.4	22	21.6	21.5
17/03/2009 09:36	1.3	0.6	0.6	0	0	0	0	0.1	1.5	1.2	21.8	17.4	22	21.6	21.5
17/03/2009 21:36	1.1	0.5	1.9	0	0	0.1	0	0.1	1.4	1.1	21.8	17.3	22.1	21.6	21.6
18/03/2009 09:36	2	0.5	1.1	0	0	0.1	0	0.1	1	1	21.8	17.3	22	21.6	21.5
18/03/2009 21:36	1.7	0.9	1.7	0	0	0.1	0	0.1	1.1	1.2	21.8	17.3	22	21.6	21.6
19/03/2009 09:36	2.1	0.7	1.6	0	0	0.1	0	0.1	1	1.1	21.8	17.3	22	21.6	21.5
19/03/2009 21:36	1.3	0.5	2.2	0	0	0.1	0	0.1	1.2	1.1	21.8	17.1	22.1	21.6	21.5
20/03/2009 09:36	1.7	1.4	1.4	0	0	0.1	0	0.1	1	1.4	21.7	17.2	21.9	21.6	21.6
20/03/2009 21:36	1.4	1.2	2.4	0	0	0.1	0	0.1	1.3	1.4	21.8	21.7	22.1	21.6	21.4

Time/Date	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	Channel 9	Channel 10	Channel 11	Channel 12	Channel 13	Channel 14	Channel 15
21/03/2009 09:36	1.5	1.8	2.5	0	0	0.1	0.1	0.1	1.6	0.9	21.8	21.6	22	21.6	21.6
21/03/2009 21:36	0.8	1.3	2.5	0	0	0.1	0	0.1	0.8	1.3	21.8	21.7	22.1	21.6	21.5
22/03/2009 09:36	1	1.8	0.9	0	0	0.1	0	0.1	1.1	1.2	21.8	21.6	22	21.6	21.6
22/03/2009 21:36	0.9	1.2	1.6	0	0	0.1	0	0.1	1.2	1.3	21.8	21.6	22	21.6	21.6
23/03/2009 09:36	1.4	1.3	1.5	0	0	0.1	0	0.1	1.2	1.4	21.8	21.5	22	21.6	21.5
23/03/2009 21:36	1.9	1.7	2.1	0	0	0.1	0	0.2	1.4	1.2	21.8	21.6	22.1	21.6	21.5
24/03/2009 09:36	1.3	1.9	1.8	0	0	0.1	0.1	0.1	1	1.2	21.7	21.6	22.1	21.6	21.4
24/03/2009 21:36	2	2.3	2.6	0	0	0.1	0	0.1	1	1.3	21.8	21.6	22.1	21.6	21.5
25/03/2009 09:36	1.6	1.8	1.6	0	0	0.1	0	0.2	1.3	1.6	21.7	21.5	22	21.5	21.5
25/03/2009 21:37	1.6	2	2.3	0	0	0.1	0	0.1	1.5	1.3	21.8	21.5	22	21.5	21.5
26/03/2009 09:37	2.2	2	1.5	0	0	0.1	0	0.1	1.2	1.4	21.7	21.5	21.8	21.5	21.5
26/03/2009 21:37	0.6	2.2	2.7	0	0	0.1	0	0.1	1.2	1.3	21.8	21.6	22.1	21.6	21.6
27/03/2009 09:37	0.6	2.1	1.6	0	0	0.1	0	0.1	1.1	1.6	21.7	21.5	21.9	21.6	21.5
27/03/2009 21:37	2.7	2.4	2.7	0	0	0.1	0	0.1	1.3	1.2	21.8	21.6	22	21.6	21.5
28/03/2009 09:37	1.8	1.7	1.7	0	0	0.1	0.1	0.1	1.3	1.1	21.8	21.5	22	21.6	21.6
28/03/2009 21:37	2.3	2	2.4	0	0	0.1	0	0.1	1.1	1.3	21.8	21.6	22.1	21.6	21.6
29/03/2009 09:37	1.8	2	1.3	0	0	0.1	0.1	0.1	1	1.3	21.8	21.5	22	21.6	21.5
29/03/2009 21:37	2.2	2	2.5	0	0	0.1	0	0.1	1.4	1.3	21.8	21.5	22	21.6	21.4
30/03/2009 09:37	0.8	1.5	1.1	0	0	0.1	0	0.1	1.4	1.3	21.7	21.5	21.9	21.5	21.5
30/03/2009 21:37	1.2	1.6	2	0	0	0.1	0.1	0.1	0.9	1.6	21.8	21.5	22	21.5	21.4
31/03/2009 09:37	0.7	1.4	1.2	0	0	0.1	0	0.1	1.5	1.2	21.7	21.5	21.9	21.6	21.6
31/03/2009 21:37	1.1	1.8	2.3	0	0	0.1	0	0.1	1.2	1.3	21.8	21.5	22	21.5	21.6
01/04/2009 09:37	1.1	1.9	1.2	0	0	0.1	0	0.1	1.3	1.4	21.7	21.5	21.9	21.6	21.5
01/04/2009 21:37	1.5	1.7	1.8	0	0	0.1	0	0.1	1.3	1.8	21.8	21.6	22	21.6	21.6
02/04/2009 09:37	1.3	1.2	0.5	0	0	0.1	0.1	0.1	1.1	1.4	21.7	21.5	21.9	21.5	21.5
02/04/2009 21:37	1	1.3	1.8	0	0	0.1	0.1	0.1	1.6	1.3	21.8	21.5	22	21.5	21.4
03/04/2009 09:37	2.1	1.8	1.4	0	0	0.1	0	0.1	1.6	1.5	21.6	21.5	21.9	21.5	21.7
03/04/2009 21:37	2.2	2.2	2.1	0	0	0.1	0	0.1	1.4	1.8	21.8	21.6	22	21.5	21.5
04/04/2009 09:37	1.4	1.1	0.7	0	0	0.1	0	0.1	1.5	1.4	21.8	21.6	21.8	21.6	21.6
04/04/2009 21:37	1.7	1.3	1.8	0	0	0.1	0	0.1	1.2	1.4	21.8	21.6	22	21.6	21.6
05/04/2009 09:37	2	1.6	1.2	0	0	0.1	0	0.1	1.2	1.3	21.8	21.6	21.9	21.6	21.5
05/04/2009 21:37	2.3	1.9	2.5	0	0	0.1	0	0.1	1.4	1.5	21.8	21.6	22	21.5	21.5
06/04/2009 09:37	2.2	1.8	2.1	0	0	0.1	0	0.1	1.5	1.5	21.7	21.5	21.9	21.5	21.5
06/04/2009 21:37	2.5	2	2.3	0	0	0.1	0	0.1	1.2	1.8	21.8	21.6	22	21.5	21.6
07/04/2009 09:37	2.3	1.9	1	0	0	0.1	0	0.1	1.2	1.4	21.7	21.5	21.8	21.5	21.6
07/04/2009 21:37	3.4	2.5	3.3	0	0	0.1	0	0.1	1.1	1.8	21.8	21.6	22	21.5	21.5
08/04/2009 09:37	1.8	1.6	1.1	0	0	0.1	0	0.1	1.4	1.7	21.7	21.4	21.8	21.5	21.5
08/04/2009 21:38	2.1	2.1	2.3	0	0	0.1	0	0.1	1.4	1.7	21.8	21.5	22	21.5	21.4
09/04/2009 09:38	3.1	2.4	2.3	0	0	0.1	0	0.1	1.2	1.7	21.7	21.4	21.9	21.5	21.4
09/04/2009 21:38	3.5	2.6	2.9	0	0	0.1	0	0.1	1.6	1.9	21.7	21.5	22	21.5	21.6

Time/Date	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	Channel 9	Channel 10	Channel 11	Channel 12	Channel 13	Channel 14	Channel 15
10/04/2009 09:38	2.6	1.7	0.7	0	0	0.1	0	0.1	1.8	1.6	21.7	21.5	21.8	21.5	21.6
10/04/2009 21:38	3	2.4	2.6	0	0	0.1	0.1	0.1	1.2	1.9	21.8	21.6	22	21.5	21.5
11/04/2009 09:38	2.5	1.9	1.8	0	0	0.1	0	0.1	1.3	1.8	21.7	21.5	22	21.6	21.4
11/04/2009 21:38	2.1	2.1	2.3	0	0	0.1	0	0.1	1.9	1.6	21.8	21.6	22	21.5	21.5
12/04/2009 09:38	2	1.7	0.8	0	0	0.1	0	0.1	1.6	1.8	21.7	21.5	21.8	21.5	21.4
12/04/2009 21:38	2	2.2	2.4	0	0	0.1	0	0.1	1.5	1.6	21.8	21.5	22	21.5	21.6
13/04/2009 09:38	2.3	1.9	1.6	0	0	0	0	0.1	1.7	1.7	21.7	21.5	21.9	21.5	21.4
13/04/2009 21:38	2.3	2	2.1	0	0	0.1	0	0.1	1.7	1.7	21.8	21.5	22	21.5	21.6
14/04/2009 09:38	2.3	2.1	1.7	0	0	0.1	0	0.1	1.6	1.6	21.7	21.4	21.9	21.5	21.6
14/04/2009 21:38	2.3	2	2.6	0	0	0.1	0	0.1	1.1	1.9	21.7	21.5	22	21.5	21.5
15/04/2009 09:38	2.5	2.4	1.6	0	0	0.1	0	0.1	1.6	1.9	21.7	21.5	21.9	21.5	21.5
15/04/2009 21:38	3	2.5	2.7	0	0	0.1	0	0.1	1.4	1.8	21.7	21.5	22	21.5	21.5
16/04/2009 09:38	2.7	2.2	1.9	0	0	0.1	0	0.1	1.5	1.6	21.7	21.5	21.9	21.5	21.5
16/04/2009 21:38	2.8	2.5	2.4	0	0	0	0	0.1	1.6	1.8	21.8	21.5	22	21.5	21.5
17/04/2009 09:38	2	2.2	2	0	0	0.1	0	0.1	1.3	1.7	21.7	21.5	22	21.5	21.4
17/04/2009 21:38	2.2	2.1	2.2	0	0	0	0	0.1	1.5	1.6	21.7	21.5	22	21.5	21.5
18/04/2009 09:38	0.3	1.3	1	0	0	0.1	0	0.1	1.4	1.8	21.7	21.5	21.9	21.6	21.5
18/04/2009 21:38	0.8	1.4	1.3	0	0	0.1	0	0.1	1.5	1.7	21.7	21.5	22	21.5	21.6
19/04/2009 09:38	0	1.3	-0.4	0	0	0.1	0	0.1	1.3	1.6	21.6	21.5	21.7	21.5	21.5
19/04/2009 21:38	0.1	1.2	1.3	0	0	0.1	0.1	0	1.3	1.7	21.7	21.5	21.9	21.5	21.5
20/04/2009 09:38	-0.5	1.5	0.4	0	0	0.1	0	0.1	1.5	1.8	21.6	21.5	21.8	21.5	21.6
20/04/2009 21:38	0.4	1.2	1.4	0	0	0.1	0.1	0	1.5	1.5	21.7	21.5	22	21.5	21.4
21/04/2009 09:38	0.8	1.5	1.2	0	0	0.1	0	0.1	1.4	1.7	21.6	21.4	21.9	21.4	21.4
21/04/2009 21:38	1	1.1	1.7	0	0	0.1	0.1	0.1	1.2	1.7	21.7	21.5	22	21.4	21.4
22/04/2009 09:38	1.6	1.9	2	0	0	0.1	0.1	0.1	1.5	1.7	21.7	21.4	21.9	21.5	21.5
22/04/2009 21:39	2.2	2	2.7	0	0	0.1	0	0.1	1.3	1.9	21.7	21.5	22	21.5	21.5
23/04/2009 09:39	1.3	1.4	1.4	0	0	0.1	0.1	0.1	1.5	1.6	21.6	21.4	21.9	21.4	21.6
23/04/2009 21:39	2.7	2.2	2.6	0	0	0.1	0	0.1	1.4	2	21.8	21.5	22	21.5	21.5
24/04/2009 09:39	2.6	1.9	2.8	0	0	0.1	0.1	0.1	1.7	1.8	21.6	21.4	21.9	21.4	21.5
25/04/2009 02:51	3.5	2.8	3.3	0	0	0.1	0	0.1	1.5	2	21.7	21.6	22	21.4	21.5
25/04/2009 14:51	2.6	2.4	2.9	0	0	0.1	0	0.1	1.7	2.3	21.7	21.5	22	21.5	21.6
26/04/2009 02:51	2.4	2.4	2.7	0	0	0.1	0	0.1	1.4	2	21.7	21.6	22	21.5	21.6
26/04/2009 14:51	0.9	2.1	1.7	0	0	0	0	0.1	1.3	2.1	21.7	21.5	21.9	21.4	21.5
27/04/2009 02:51	2.9	2.9	2.8	0	0	0.1	0	0.1	1.6	2.5	21.7	21.6	22	21.5	21.5
27/04/2009 14:51	0.7	2.2	2.6	0	0	0.1	0.1	0.1	1.6	2.2	21.6	21.4	21.9	21.4	21.5
28/04/2009 02:51	2.9	3.3	2.7	0	0	0.1	0.1	0.1	1.3	2.5	21.7	21.6	22	21.5	21.5
28/04/2009 14:51	1.3	2.4	1.5	0	0	0.1	0	0.1	1.4	2.3	21.6	21.4	21.9	21.4	21.5
29/04/2009 02:51	2.5	2.5	2.2	0	0	0.1	0	0.1	1.6	2.4	21.7	21.6	22	21.4	21.4
29/04/2009 14:51	1.6	2.5	2.4	0	0	0.1	0.1	0.1	1.4	2.2	21.7	21.5	21.9	21.4	21.3
30/04/2009 02:51	2.4	2.9	2.8	0	0	0.1	0	0.2	1.5	2.8	21.7	21.5	22	21.4	21.3

Time/Date	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	Channel 9	Channel 10	Channel 11	Channel 12	Channel 13	Channel 14	Channel 15
30/04/2009 14:51	1.1	1	1.3	0	0	0.1	0.1	0	1.5	2.1	21.7	21.3	21.9	21.3	21.4
01/05/2009 02:52	1.8	2.2	2.7	0	0	0.1	0	0.1	1.5	2.1	21.7	21.6	22	21.5	21.4
01/05/2009 14:52	-0.4	1.1	1.2	0	0	0.1	0.1	0.1	1.7	2	21.6	21.3	21.8	21.4	21.3
02/05/2009 02:52	2	2	3.1	0	0	0.1	0.1	0.1	1.5	2.2	21.8	21.6	22	21.5	21.6
02/05/2009 14:52	-0.3	1.3	1	0	0	0.1	0.1	0.2	1.3	2.2	21.6	21.4	21.9	21.4	21.4
03/05/2009 02:52	2.7	1.9	2.6	0	0	0.1	0	0.1	1.5	2.2	21.8	21.6	22	21.5	21.6
03/05/2009 14:52	0.3	0.9	1.1	0	0	0.1	0	0	1.4	1.8	21.7	21.4	21.9	21.4	21.6
04/05/2009 02:52	2.5	2.1	2.6	0	0	0.1	0	0.2	1.3	1.9	21.8	21.6	22	21.5	21.4
04/05/2009 14:52	2.1	1.7	2.3	0	0	0.1	0	0.1	1.5	2.4	21.8	21.5	22	21.5	21.5
05/05/2009 02:52	2.8	2.1	2.7	0	0	0.1	0	0.1	1.3	2.2	21.8	21.5	22	21.5	21.6
05/05/2009 14:52	-0.1	1.5	1.7	0	0	0.1	0.1	0	1.5	2.4	21.6	21.4	21.9	21.3	21.3
06/05/2009 02:52	2.6	2.4	2.5	0	0	0	0	0.1	1.4	2.4	21.7	21.5	22	21.4	21.5
06/05/2009 14:52	1.5	1.7	2.2	0	0	0.1	0	0.2	1.5	2.6	21.6	21.4	21.9	21.4	21.4
07/05/2009 02:52	3.7	2.7	3.5	0	0	0.1	0	0.2	1.7	2.4	21.8	21.6	22	21.5	21.4
07/05/2009 14:52	1.5	1.7	2.3	0	0	0.1	0	0.1	1.4	2.3	21.6	21.5	22	21.4	21.5
08/05/2009 02:52	4.4	3	3.5	0	0	0.1	0	0.2	1.5	2.3	21.8	21.6	22	21.5	21.3

Data lost due to PC error during service visit by CSL - there were no alarms in this period

26/06/2009 00:40	1.4	1.8	0.6	0	0	0.1	0.1	0.1	2	0.9	21.6	21.3	21.8	21.7	21.7
26/06/2009 12:40	2.4	3.4	1.2	0	0	0.1	0.1	0	1.4	1.2	21.5	21.2	21.8	21.8	21.8
27/06/2009 00:40	1.8	2	1.7	0	0	0.1	0.1	0.1	2.4	1.2	21.6	21.3	21.8	21.8	21.5
27/06/2009 18:10	0.8	0.6	0.2	0	0	0.1	0.1	0	0.8	0.5	21.4	21.2	21.7	21.7	21.3
28/06/2009 06:10	3	1.4	1.8	0	0	0.1	0.1	0.1	2	0.8	21.6	21.5	21.9	21.8	22
28/06/2009 18:10	2.6	1.7	1.2	0	0	0.1	0	0.1	1.2	0.6	21.6	21.4	21.9	21.8	21.9
29/06/2009 06:10	3.4	2.4	2.4	0	0	0.1	0.1	0.1	0.8	1.4	21.7	21.5	22	21.8	21.8
29/06/2009 18:10	-1.1	1.7	-0.3	0	0	0.1	0.1	0	0.6	1.4	21.4	21.1	21.7	21.7	21.8
30/06/2009 06:10	3	1.7	1.4	0	0	0.1	0	0.1	0.9	0.3	21.6	21.4	21.9	21.8	21.6
30/06/2009 18:10	0.8	3.7	1.1	0	0	0.1	0.1	0	1.1	1.7	21.4	21.2	21.7	21.7	21.9
01/07/2009 06:10	1.7	2	1.4	0	0	0.1	0	0	1.7	1.5	21.5	21.4	21.8	21.8	21.7
01/07/2009 18:10	1.8	1.8	0.9	0	0	0.1	0.1	0.1	2.1	1.4	21.5	21.2	21.8	21.7	20.9
02/07/2009 06:10	2.7	1.4	1.8	0	0	0	0	0	1.4	0.9	21.5	21.4	21.8	21.8	22
03/07/2009 05:02	3.4	2.4	2.4	0	0	0	0	0.1	0.9	2.1	21.6	21.4	21.9	21.8	22
03/07/2009 17:02	0.5	1.1	0	0	0	0.1	0.1	0	1.4	1.5	21.4	21.2	21.7	21.7	22
04/07/2009 05:02	2.7	1.5	1.8	0	0	0	0.1	0.1	2	1.1	21.6	21.4	21.9	21.8	22
04/07/2009 17:02	0.8	1.1	0.5	0	0	0.1	0.1	0	1.2	1.2	21.4	21.3	21.8	21.7	21.8
05/07/2009 05:02	3	1.8	2.6	0	0	0.1	0.1	0.1	1.8	1.8	21.6	21.5	21.9	21.8	21.8
05/07/2009 17:02	1.8	2	0.9	0	0	0	0	0	0.9	2.6	21.4	21.3	21.8	21.7	21.7
06/07/2009 05:02	3.5	2.4	2.7	0	0	0.1	0.1	0.1	0.2	1.4	21.6	21.4	21.9	21.8	21.8
06/07/2009 21:09	3.7	2.3	2.1	0	0	0.1	0	0	1.4	1.4	21.6	21.4	21.9	21.8	22

Time/Date	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	Channel 9	Channel 10	Channel 11	Channel 12	Channel 13	Channel 14	Channel 15
07/07/2009 09:09	3.5	2.4	2.4	0	0	0.1	0.1	0.1	0.5	1.4	21.6	21.5	21.8	21.8	22.1
08/07/2009 05:05	3.2	2.4	2	0	0	0.1	0.1	0.1	0.8	1.7	21.6	21.5	22	21.9	22
08/07/2009 17:05	0.5	1.7	0.9	0	0	0.1	0	0.1	1.4	2	21.5	21.4	21.8	21.8	21.8
09/07/2009 05:05	2.6	2.1	2.1	0	0	0.1	0.1	0	0.8	0.6	21.6	21.5	22	21.8	21.7
09/07/2009 17:05	-0.8	0.6	0.6	0	0	0.1	0.1	0.1	0.9	1.1	21.5	21.3	21.8	21.8	21.9
10/07/2009 05:05	2.6	2.3	2	0	0	0.1	0.1	0.1	0.8	1.4	21.6	21.5	21.9	21.9	22.1
10/07/2009 17:05	2	3.7	1.5	0	0	0	0.1	0.1	1.1	1.2	21.5	21.4	21.8	21.8	21.8
11/07/2009 05:05	2.6	2.4	1.5	0	0	0.1	0.1	0.1	2.1	2.7	21.5	21.5	21.9	21.9	21.9
11/07/2009 17:05	3	3.8	2.6	0	0	0	0.1	0.1	0.6	2.1	21.5	21.4	21.8	21.8	21.9
12/07/2009 05:05	3.8	2.3	2.9	0	0	0.1	0.1	0.1	1.7	1.2	21.6	21.5	21.9	21.8	21.8
12/07/2009 17:06	1.5	2	1.1	0	0	0.1	0	0.1	1.4	1.1	21.4	21.4	21.8	21.8	21.8
13/07/2009 05:06	4.3	2.4	2.7	0	0	0.1	0.1	0	2.1	1.5	21.6	21.5	21.9	21.8	22
13/07/2009 17:06	2.9	1.8	1.2	0	0	0	0	0.1	2.3	1.8	21.5	21.3	21.8	21.8	21.9
14/07/2009 05:06	3.8	2	1.8	0	0	0.1	0.1	0.1	1.8	0.8	21.5	21.5	22	22	22
14/07/2009 17:06	2.6	2.4	1.1	0	0	0.1	0.1	0	0.9	2	21.5	21.2	21.8	21.8	21.8
15/07/2009 05:06	3.2	2.7	2.9	0	0	0.1	0.1	0.1	1.7	1.4	21.5	21.5	21.9	21.8	22
15/07/2009 17:06	0.5	0.9	0.6	0	0	0.1	0.1	0.1	0.5	1.7	21.4	21.2	21.8	21.8	21.8
16/07/2009 05:06	3.2	2.3	1.5	0	0	0.1	0	0.1	2.7	1.5	21.6	21.5	22	21.9	21.8
16/07/2009 17:06	0.3	1.1	-0.2	0	0	0.1	0.1	0	0.9	2.1	21.4	21.3	21.8	21.8	21.9
17/07/2009 05:06	3.4	2.4	2.9	0	0	0.1	0.1	0.1	0.8	1.8	21.5	21.5	21.9	21.8	21.9
17/07/2009 17:06	0.5	1.1	0.5	0	0	0.1	0.1	0.1	1.4	0.9	21.3	21.3	21.8	21.8	20.9
18/07/2009 05:06	2.4	2.1	1.7	0	0	0.1	0.1	0.1	1.2	1.1	21.5	21.5	21.9	21.8	21.1
18/07/2009 17:06	1.7	2.1	1.4	0	0	0	0.1	0.1	0.8	2.4	21.4	21.4	21.8	21.8	21.8
19/07/2009 05:06	3.2	3.2	1.8	0	0	0.1	0	0.2	1.2	1.7	21.5	21.5	21.9	21.8	21
19/07/2009 17:06	0.8	2.4	0.6	0	0	0.1	0.1	0.1	1.2	1.2	21.2	21.3	21.8	21.8	21.8
20/07/2009 05:06	3.2	2.3	2.3	0	0	0.1	0.1	0.1	1.2	1.5	21.4	21.5	22	21.9	21.9
20/07/2009 17:06	0.8	2.1	1.5	0	0	0.1	0.1	0	1.5	1.8	21.2	21.3	21.8	21.8	21.8
21/07/2009 05:06	3.7	2.3	3	0	0	0.1	0.1	0	1.5	1.8	21.2	21.5	21.9	21.8	22
21/07/2009 17:06	2.6	2.1	1.5	0	0	0.1	0.1	0	1.4	1.7	21.3	21.3	21.9	21.8	22
22/07/2009 05:06	4	2.9	2.6	0	0	0	0.1	0	0.2	1.8	21.4	21.4	21.9	21.8	21.7
22/07/2009 17:06	2.9	3.2	3	0	0	0	0.1	0	1.8	2	21.3	21.3	21.8	21.8	21.8
23/07/2009 05:06	3.7	2.7	2.9	0	0	0.1	0.1	0.1	1.4	1.4	21.4	21.5	21.8	21.8	21.9
23/07/2009 17:06	2.4	2	1.7	0	0	0.1	0.1	0	1.4	2.1	21.2	21.3	21.8	21.8	22
24/07/2009 05:06	3.8	2.7	2.9	0	0	0.1	0.1	0.1	1.4	2	21.4	21.5	21.9	21.8	21.8
24/07/2009 17:06	0.8	2	1.4	0	0	0.1	0.1	0.1	0.6	2.1	21.3	21.3	21.8	21.8	21.8
25/07/2009 05:06	3.4	4	2.4	0	0	0.1	0.1	0.1	1.5	1.7	21.3	21.5	21.9	21.9	21.8
25/07/2009 17:07	1.4	1.1	1.1	0	0	0.1	0.1	0	1.8	2.1	21.2	21.4	21.8	21.9	21.8
26/07/2009 05:07	3	2.6	2.4	0	0	0.1	0	0	1.2	1.4	21.2	21.5	21.8	21.8	21.6
26/07/2009 17:07	2.3	2.1	1.7	0	0	0	0	0	1.4	2.1	21.1	21.3	21.8	21.8	21.8
27/07/2009 05:07	3.5	2.4	2.6	0	0	0.1	0.1	0.1	1.1	1.7	21.2	21.5	21.9	21.8	22

Time/Date	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	Channel 9	Channel 10	Channel 11	Channel 12	Channel 13	Channel 14	Channel 15
27/07/2009 17:07	1.7	1.4	1.7	0	0	0.1	0.1	0	1.2	1.7	20	21.3	21.8	21.8	21.8
28/07/2009 05:07	3.7	2.6	2.7	0	0	0.1	0.1	0.1	0.6	2.7	3	21.5	21.9	21.8	21.8
28/07/2009 17:07	3	2.7	2.4	0	0	0	0.1	0	1.7	1.8	3.1	21.4	21.8	21.8	21.8
29/07/2009 05:07	4.1	2.9	3	0	0	0.1	0.1	0.1	1.5	2	3	21.5	21.9	21.8	21.9
29/07/2009 17:07	2	2.1	1.5	0	0	0.1	0.1	0.1	1.2	2.1	21.8	21.3	21.8	21.8	21.8
30/07/2009 05:07	3.7	2.6	2.6	0	0	0.1	0.1	0.1	1.2	1.5	22	21.5	21.9	21.8	21.8
30/07/2009 17:07	0	0.6	0.8	0	0	0.1	0.1	0	2	2	21.7	21.3	21.8	21.8	21.8
31/07/2009 05:07	2.4	4	2.4	0	0	0.1	0.1	0	1.4	1.2	21.9	21.5	21.9	21.8	21.9
31/07/2009 17:07	3	2.4	2.9	0	0	0.1	0.1	0.1	1.8	2.3	21.8	21.4	21.8	21.8	21.8
01/08/2009 05:07	4.4	2.1	3	0	0	0.1	0.1	0.1	1.8	2.3	21.9	21.5	21.8	21.8	21.8
01/08/2009 17:07	1.5	1.7	1.4	0	0	0.1	0.1	0.1	1.5	2.3	21.7	21.3	21.8	21.7	21.8
02/08/2009 05:07	3.5	2.1	2.6	0	0	0.1	0.1	0.1	1.1	1.8	21.9	21.5	21.9	21.8	21.9
02/08/2009 17:07	2.7	1.4	2.3	0	0	0	0	0	1.5	2.6	21.8	21.3	21.8	21.8	21.8
03/08/2009 05:07	4	2.6	3.5	0	0	0	0.1	0.1	0.9	1.4	21.9	21.4	21.8	21.7	21.9
03/08/2009 17:07	2.7	2	2	0	0	0	0.1	0	1.5	2	21.8	21.3	21.8	21.6	21.8
04/08/2009 05:07	4	2.6	2.4	0	0	0.1	0	0	1.4	2.7	21.8	21.4	21.8	21.6	21.8
04/08/2009 17:07	2.4	1.2	2	0	0	0	0.1	0	2.1	1.8	21.8	21.2	21.8	21.5	21.8
05/08/2009 05:07	4	2	2.6	0	0	0	0	0.1	1.7	2	21.9	21.4	21.8	21.6	21.8
05/08/2009 17:07	2	1.1	1.1	0	0	0.1	0.1	0	1.4	2.4	21.8	21.2	21.8	21.5	21.7
06/08/2009 05:07	2.1	3.5	2.3	0	0	0.1	0.1	0.1	1.1	1.5	21.9	21.5	21.9	21.5	21.8
06/08/2009 17:07	1.5	1.5	1.4	0	0	0.1	0.1	0	1.5	1.4	21.8	21.3	21.8	21.4	21.8
07/08/2009 05:07	3.5	1.7	2.1	0	0	0.1	0.1	0.1	1.4	2	21.9	21.5	21.9	21.5	21.8
07/08/2009 17:07	1.2	2.6	0.9	0	0	0.1	0.1	0	1.5	1.7	21.8	21.3	21.8	21.5	21.8
08/08/2009 05:08	2.9	2.3	2.1	0	0	0.1	0.1	0	1.5	3	21.9	21.5	21.8	21.5	21.8
08/08/2009 17:08	1.2	3.4	1.1	0	0	0.1	0	0	2.1	2.6	21.7	21.3	21.7	21.5	21.7
09/08/2009 05:08	3.4	2.7	1.7	0	0	0.1	0.1	0.1	1.1	1.8	21.9	21.5	21.9	21.5	21.8
10/08/2009 03:23	3.5	2.6	2.4	0	0	0	0	0.1	1.2	2.1	21.8	21.4	21.8	21.5	21.8
10/08/2009 15:23	2	3.4	1.7	0	0	0.1	0.1	0.1	1.7	2.4	21.7	21.2	21.7	21.4	21.8
11/08/2009 03:23	3.2	1.7	2.4	0	0	0	0.1	0	2.6	1.8	21.8	21.5	21.8	21.5	21.8
11/08/2009 15:23	1.4	1.7	1.4	0	0	0.1	0.1	0	1.2	2	21.7	21.2	21.7	21.5	21.8
12/08/2009 03:23	2.4	2.1	2	0	0	0.1	0.1	0.1	1.5	2.7	21.8	21.4	21.8	21.4	21.8
12/08/2009 15:23	2.9	2	2.6	0	0	0.1	0.1	0	1.7	2.3	21.8	21.3	21.7	21.4	21.8
13/08/2009 03:23	3	2.1	1.4	0	0	0.1	0.1	0.1	2.1	1.5	21.9	21.5	21.9	21.4	21.8
13/08/2009 15:23	0.5	0.6	0.6	0	0	0.1	0.1	0	1.5	2.1	21.8	21.3	21.8	21.3	21.8
14/08/2009 03:23	2.9	1.8	2	0	0	0.1	0.1	0.1	1.7	2.1	21.8	21.4	21.8	21.3	21.7
14/08/2009 15:23	2.1	2.3	1.7	0	0	0	0.1	0	1.7	1.7	21.7	21.3	21.6	21.2	21.7
15/08/2009 03:23	3.5	3.8	2.3	0	0	0	0.1	0.1	1.5	2.4	21.8	21.4	21.8	21.2	21.7
15/08/2009 15:23	2.1	1.8	1.7	0	0	0	0.1	0	1.7	2.3	21.7	21.3	21.7	21.2	21.8
16/08/2009 03:23	2.9	4	2.4	0	0	0.1	0.1	0.1	1.7	2.6	21.9	21.5	21.9	21.3	21.8
16/08/2009 15:23	2.7	1.7	1.7	0	0	0	0.1	0.1	0.9	2.7	21.8	21.4	21.8	21.3	21.8

Time/Date	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	Channel 9	Channel 10	Channel 11	Channel 12	Channel 13	Channel 14	Channel 15
17/08/2009 03:23	3.4	3.2	2.3	0	0	0	0.1	0	1.8	4	21.9	21.5	21.8	21.2	22
17/08/2009 15:24	0.8	1.8	1.5	0	0	0.1	0.1	0	1.4	1.8	21.7	21.3	21.8	21.1	21.7
18/08/2009 03:24	2.9	2	2	0	0	0	0.1	0.1	1.5	2.7	21.8	21.4	21.8	21.1	20.9
19/08/2009 03:24	3	2.6	3	0	-0.1	0	0	0.1	1.5	3.8	21.8	21.4	21.7	21	21.7
19/08/2009 15:24	3	2.4	2.1	0	0	0.1	0.1	0	0.5	2.1	21.7	21.3	21.7	20.7	21.8
20/08/2009 03:24	3.4	3.2	2.9	0	0	0.1	0.1	0.1	1.5	2.9	21.8	21.3	21.8	20.8	21.8
20/08/2009 15:24	2.3	1.7	0.9	0	0	0.1	0.1	0	1.5	2.6	21.8	21.3	21.7	20.7	21.8
21/08/2009 03:24	4.3	1.8	2.9	0	0	0.1	0.1	0.1	1.5	2	21.9	21.5	21.9	20.7	21.9
21/08/2009 15:24	1.4	1.8	0.8	0	0	0.1	0.1	0	0.6	2.6	21.8	21.4	21.8	20.7	21.8
22/08/2009 03:24	3.4	2.1	2.6	0	0	0.1	0.1	0.1	1.2	2.7	22	21.5	21.9	20.7	21.9
22/08/2009 15:24	1.2	1.7	0.2	0	0	0.1	0.1	0	1.7	3.2	21.8	21.3	21.8	20.7	21.7
23/08/2009 03:24	4	2.6	2.6	0	0	0.1	0	0	1.5	1.8	21.9	21.4	21.8	20.7	21.8
23/08/2009 15:24	4	2.9	2.9	0	0	0	0.1	0	1.5	2.7	21.8	21.3	21.8	20.6	21.8
24/08/2009 03:24	4.6	2.6	3	0	0	0.1	0.1	0.1	1.8	1.7	21.9	21.5	21.8	20.5	21.9
24/08/2009 15:24	2.7	1.7	0.9	0	0	0.1	0.1	0	1.5	2	21.8	21.3	21.8	20.5	21.8
25/08/2009 03:24	4	2.6	2.7	0	0	0.1	0.1	0.1	2.1	2.6	22	21.5	21.9	20.5	21.8
25/08/2009 15:24	3	2.3	1.7	0	0	0	0.1	0	1.8	2.7	21.8	21.3	21.8	20.5	21.8
26/08/2009 03:24	4.7	3	3.7	0	0	0	0	0	1.7	3.2	21.9	21.4	21.8	20.5	21.8
26/08/2009 15:24	2.6	2.4	2	0	0	0	0	0	2.1	2.9	21.7	21.3	21.8	20.4	21.8
27/08/2009 03:24	4	2	3	0	0	0.1	0.1	0.1	1.5	1.8	22	21.5	21.8	20.5	21.8
27/08/2009 15:24	2.4	2.7	2.1	0	0	0.1	0.1	0.1	2.3	2.6	21.8	21.3	21.7	20.5	21.8
28/08/2009 03:24	4.1	2.7	3.5	0	0	0.1	0.1	0.1	1.2	3.4	22	21.5	21.8	20.5	21.9
28/08/2009 15:24	1.7	3.4	1.5	0	0	0.1	0.1	0.1	1.7	2.3	21.8	21.3	21.8	20.5	21.8
29/08/2009 03:24	4.4	2.6	4	0	0	0.1	0.1	0.1	2.6	2.4	22	21.5	21.9	20.5	21.9
29/08/2009 15:24	2	3.7	1.2	0	0	0	0.1	0	1.7	2.1	21.8	21.4	21.8	20.5	21.8
30/08/2009 03:24	3.7	2.3	2.7	0	0	0.1	0.1	0	2	2	22	21.5	21.9	20.5	21.9
30/08/2009 15:24	3.4	2.9	2.3	0	0	0	0	0.2	0.6	2.7	21.8	21.3	21.7	20.5	21.6
31/08/2009 03:25	4.1	2.9	3	0	0	0	0.1	0.1	1.5	3.7	21.8	21.4	21.7	20.4	21.8
31/08/2009 15:25	4	2.3	2.6	0	0	0.1	0.1	0.1	2	3	21.8	21.3	21.6	20.3	21.8
01/09/2009 03:25	4.4	2.9	4.1	0	0	0.1	0.1	0.1	0.8	3.2	21.9	21.5	21.8	20.4	21.8
01/09/2009 15:25	3.4	1.8	2	0	0	0.1	0.1	0.1	1.7	2.7	21.8	21.3	21.6	20.3	21.8
02/09/2009 03:25	4.4	2.1	3	0	0	0.1	0.1	0.1	1.7	2.6	22	21.5	21.8	20.4	21.9
02/09/2009 15:25	4.9	2.6	2.7	0	0	0	0.1	0.1	1.2	3.4	21.9	21.2	21.7	20.4	21.9
03/09/2009 03:25	4.6	2.6	4.3	0	0	0.1	0.1	0.1	1.7	2.4	21.9	21.5	21.8	20.4	21.9
03/09/2009 15:25	3.4	2.3	2	0	0	0.1	0.1	0.1	2.1	2.4	21.9	21.3	21.6	20.4	22
04/09/2009 03:25	4.9	2	3.5	0	0	0.1	0	0.2	1.5	2.4	22	21.5	21.8	20.4	21.9

Data lost due to PC error during service visit by CSL - there were no alarms in this period

Time/Date	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	Channel 9	Channel 10	Channel 11	Channel 12	Channel 13	Channel 14	Channel 15
24/09/2009 04:38	4.3	1.7	3	0	0	0.1	0.1	0.1	1.5	2.7	22	21.5	21.8	25	21.8
24/09/2009 16:38	0.9	1.2	1.5	0	0	0.1	0.1	0.1	2.6	3.7	21.9	21.4	21.8	24.8	21.8
25/09/2009 04:38	3.2	4.1	2	0	0	0	0.1	0.1	2.1	2.9	22	21.5	21.9	24.9	21.9
25/09/2009 16:38	0.6	1.2	1.4	0	0	0.1	0.1	0.1	1.8	3.4	21.8	21.3	21.7	24.8	21.7
26/09/2009 04:38	3	4.3	2.4	0	0	0	0.1	0.1	2.1	3.2	22	21.5	21.8	24.9	21.8
26/09/2009 16:39	1.5	2	1.4	0	0	0	0.1	0	2	2.6	21.9	21.4	21.7	24.8	20.9
27/09/2009 04:39	2.9	2.1	2.4	0	0	0.1	0.1	0.1	1.7	3.5	22	21.5	21.8	24.9	22
27/09/2009 16:39	2.1	2	1.5	0	0	0	0	0.1	1.5	3.5	21.9	21.4	21.7	24.9	21.7
28/09/2009 04:39	3.8	2.3	3.4	0	0	0.1	0.1	0.1	1.8	3.4	22	21.5	21.8	25	21.8
28/09/2009 16:39	1.8	2.1	2.3	0	0	0.1	0.1	0.3	1.8	3.8	21.8	21.4	21.7	24.9	22
29/09/2009 04:39	3.5	2.3	1.1	0	0	0	0.1	0.1	2.7	3	22	21.5	21.7	25	22
29/09/2009 16:39	2.4	1.7	1.7	0	0	0	0.1	0.1	1.8	3	21.9	21.3	21.7	24.8	22
30/09/2009 04:39	3.8	2.4	2.4	0	0	0.1	0.1	0.1	2.1	3.4	22	21.5	21.8	24.9	21.9
30/09/2009 16:39	1.4	1.7	2	0	0	0	0.1	0.1	1.5	2.7	21.9	21.3	21.8	24.8	21.8
01/10/2009 04:39	3.5	4	2.3	0	0	0.1	0	0.1	2.1	3	22	21.5	21.8	25	22
01/10/2009 16:39	1.5	3.4	1.1	0	0	0	0.1	0	1.8	2.3	21.9	21.5	21.9	25	22.1
02/10/2009 04:39	3.4	2.4	2.7	0	0	0.1	0.1	0.1	2.1	3.4	22	21.6	21.8	24.9	22.1
02/10/2009 16:39	3.5	1.7	2.6	0	0	0	0.1	0.1	2	2.9	22	21.3	21.7	25	21.8
03/10/2009 04:39	2.7	3.4	2.4	0	0	0	0.1	0.1	1.7	2.9	22	21.5	21.7	24.9	21.9
03/10/2009 16:39	3.8	1.7	2.3	0	0	0	0.1	0.1	1.8	3.7	22	21.3	21.7	24.9	21.9
04/10/2009 04:39	4.7	2.3	3.4	0	0	0.1	0.1	0.1	2.3	2.7	22	21.5	21.8	25	21.9
04/10/2009 16:39	3.2	3.5	1.8	0	0	0.1	0	0.1	1.8	3	22	21.5	21.8	25	21.9
05/10/2009 04:39	4.9	2.6	3.4	0	0	0.1	0.1	0.1	2.4	3.8	22	21.5	21.7	24.9	21.8
05/10/2009 16:39	2.9	2.3	2.4	0	0	0	0.1	0.1	2.1	2.9	21.9	21.4	21.8	24.8	21.8
06/10/2009 04:39	4	2.6	3.5	0	0	0.1	0	0.1	3	3.5	22	21.5	21.7	24.9	21.8
06/10/2009 16:39	3.2	2.6	2.6	0	0	0.1	0.1	0.1	2.3	2.7	21.9	21.4	21.6	24.9	21.9
07/10/2009 04:39	4.9	2.6	4.4	0	0	0.1	0.1	0.1	2.1	2.9	22	21.6	21.7	25	22
07/10/2009 16:39	2.1	0.9	2.3	0	0	0.1	0.1	0.1	2.1	2.3	22	21.2	21.8	24.8	22
08/10/2009 04:39	3.8	1.7	4	0	0	0.1	0.1	0.1	2	4	22	21.5	21.8	24.9	22
08/10/2009 16:39	1.1	0.6	1.7	0	0	0	0.1	0	1.8	3.2	21.9	21.3	21.8	24.8	21.9
09/10/2009 04:39	2.7	2.1	3.5	0	0	0.1	0	0.1	2.6	2.6	22	21.5	21.8	24.9	21.9
09/10/2009 16:39	3	1.8	1.7	0	0	0	0.1	0.1	2.1	3.2	21.9	21.1	21.6	24.8	21.9
10/10/2009 04:40	4.1	2.7	4.3	0	0	0.1	0	0.1	0.8	4.1	22	21.5	21.7	24.9	21.9
10/10/2009 16:40	2.7	1.7	1.8	0	0	0	0.1	0.1	1.7	3	21.8	21	21.6	24.8	22
11/10/2009 04:40	3.8	1.8	3.4	0	0	0.1	0	0.2	2.1	2.6	22	21.4	21.7	24.9	21.8
11/10/2009 16:40	2.6	0.8	1.5	0	0	0	0.1	0	1.5	3	21.9	20.9	21.6	24.8	22
12/10/2009 04:40	4.1	1.4	4	0	0	0.1	0.1	0.1	2.1	2.9	22	21.5	21.7	25	22
12/10/2009 16:40	1.2	0	1.1	0	0	0.1	0.1	0.1	1.5	3	21.9	21.2	21.6	24.8	21.9
13/10/2009 04:40	3.2	2.7	2.7	0	0	0.1	0.1	0.2	2.4	4.3	22	21.4	21.8	25	21.8
14/10/2009 01:50	2.9	1.2	3	0	0	0.1	0.1	0.2	2	3.2	22	21.3	21.7	24.9	21.8

Time/Date	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	Channel 9	Channel 10	Channel 11	Channel 12	Channel 13	Channel 14	Channel 15
14/10/2009 13:50	2.4	1.2	0.9	0	0	0	0.1	0.1	2.1	3	21.9	21.3	21.6	24.7	22
15/10/2009 01:51	3.4	1.7	2.4	0	0	0.1	0.1	0.1	1.7	3	22	21.5	21.7	24.9	21.8
15/10/2009 13:51	2.3	2.3	1.4	0	0	0.1	0.1	0.1	1.8	3	22	21.5	21.5	24.8	21.9
16/10/2009 01:51	3.5	2.3	2.1	0	0	0.1	0.1	0.1	2	3	22	21.5	21.7	24.9	21.9
16/10/2009 13:51	2.7	3.5	0.9	0	0	0.1	0.1	0.1	1.8	3.4	22	21.5	21.8	24.9	21.2
17/10/2009 01:51	3.8	1.7	3.2	0	0	0.1	0.1	0.1	2.1	2.9	22	21.6	21.7	25	21.9
17/10/2009 13:51	2.9	1.7	0.5	0	0	0.1	0.1	0.1	1.5	3.2	22	21.5	21.6	24.9	21.9
18/10/2009 01:51	3.2	2.4	2.7	0	0	0.1	0.1	0.1	1.7	3.4	22	21.6	21.7	25	21.8
18/10/2009 13:51	3.5	2.7	2.3	0	0	0	0.1	0.1	1.1	3	22	21.5	21.7	24.9	21.8
19/10/2009 01:51	4.1	2.9	3.4	0	0	0.1	0.1	0.2	1.5	4.4	22	21.5	21.7	24.9	22
19/10/2009 13:51	4.6	2.4	2.7	0	0	0.1	0.1	0.1	2.3	4.7	22	21.4	21.6	24.9	21.9
20/10/2009 01:51	5.6	4.3	4.3	0	0	0.1	0.1	0.1	1.5	4.4	22	21.5	21.6	24.9	21.8
20/10/2009 13:51	5.2	2.1	2.9	0	0	0.1	0.1	0.1	2.4	3.7	21.9	21.2	21.6	24.8	21.9
21/10/2009 01:51	6.3	2.6	4	0	0	0.1	0.1	0.1	2.3	4	21.9	21.4	21.7	24.9	21.9
21/10/2009 13:51	5.6	2.4	3.7	0	0	0.1	0.1	0	2.3	4.1	21.9	21.2	21.6	24.8	21.9
22/10/2009 01:51	5.2	4.1	3.8	0	0	0.1	0.1	0.1	2.4	3.5	22	21.4	21.6	24.9	22
22/10/2009 13:51	4.3	1.8	2.3	0	0	0	0.1	0.1	2.3	3.7	21.8	21.1	21.6	24.8	22
23/10/2009 01:51	5	2.3	3.4	0	0	0.1	0.1	0.2	2.3	3.7	22	21.4	21.6	24.9	21.8
23/10/2009 13:51	4.1	1.7	2.9	0	0	0	0.1	0.1	2.1	4	21.9	21.2	21.6	24.8	22
24/10/2009 01:51	4.7	2.1	2.9	0	0	0	0	0.1	3.7	3.4	22	21.3	21.6	24.8	21.9
24/10/2009 13:51	4.6	2.3	3.2	0	0	0	0	0.2	2	4.9	21.9	21.2	21.6	24.8	21.8
25/10/2009 04:02	5.2	2.9	3.5	0	0	0.1	0	0.1	2.7	4.7	22	21.4	21.7	24.9	22
25/10/2009 16:02	4.1	1.2	3	0	0	0	0.1	0.1	2.3	3.5	22	21.2	21.6	24.8	21.9
26/10/2009 04:02	4.7	1.8	3.7	0	0	0.1	0.1	0.1	2.6	3.2	22	21.5	21.6	25	22
26/10/2009 16:02	4.6	1.4	2.7	0	0	0.1	0	0.1	3.2	3.2	22	21.2	21.6	24.9	22
27/10/2009 04:02	5.3	2.1	3.5	0	0	0	0	0.1	2.4	4.1	22	21.3	21.5	24.9	22
27/10/2009 16:02	3.7	2.1	3.5	0	0	0.1	0.1	0.1	2.1	3.8	21.9	21.1	21.5	24.7	21.9
28/10/2009 04:02	5.3	2.6	3.7	0	0	0.1	0	0.2	2.4	4	22	21.4	21.6	24.9	21.9
28/10/2009 16:02	4	1.8	1.8	0	0	0.1	0	0.2	2	5.2	21.9	21.3	21.6	24.8	21.8
29/10/2009 04:02	4.4	2.4	3.2	0	0	0	0	0.1	2.1	3.7	22	21.5	21.6	24.9	21.8
29/10/2009 16:02	4.3	2.4	4.9	0	0	0	0	0.1	2.3	4.3	21.9	21.4	21.5	24.8	21.9
30/10/2009 04:02	4.4	2.9	3.5	0	0	0	0	0.1	1.8	4.6	21.9	21.4	21.5	24.8	21.7
30/10/2009 16:02	4.6	4.6	2.3	0	0	0.1	0.1	0	1.5	3.5	21.9	21.3	21.5	24.6	21.8
31/10/2009 04:02	3.7	2.7	3.5	0	0	0	0.1	0.1	2.4	4.6	22	21.5	21.6	24.7	21.8
31/10/2009 16:02	4.1	2.6	1.7	0	0	0	0.1	0.2	2.6	3.4	22	21.4	21.6	24.7	21.8
01/11/2009 04:02	5	2.9	3.5	0	0	0	0.1	0.2	2.3	4.9	22	21.5	21.6	24.7	21.8
01/11/2009 16:02	5	2.9	3.5	0	0	0	0	0.1	2.3	3.7	22	21.5	21.6	24.7	22
02/11/2009 04:02	5.9	2.9	3.8	0	0	0.1	0	0.1	2.6	3.4	22	21.6	21.6	24.9	22
02/11/2009 16:02	4.4	4.9	2.4	0	0	0.1	0.1	0.1	2.3	4.9	21.9	21.5	21.6	24.8	22
03/11/2009 04:02	5.9	3.2	3.8	0	0	0.1	0.1	0.1	3.4	3.4	22	21.5	21.6	24.8	22

Time/Date	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	Channel 9	Channel 10	Channel 11	Channel 12	Channel 13	Channel 14	Channel 15
03/11/2009 16:02	4.9	3.5	3	0	0	0.1	0	0.1	2.6	4.7	21.9	21.5	21.6	24.8	22
04/11/2009 04:02	5	3.8	3.7	0	0	0	0	0.1	2.4	4.1	22	21.6	21.6	24.9	22
04/11/2009 16:02	4.1	2.9	2.9	0	0	0.1	0.1	0.1	3.2	4.9	21.9	21.3	21.5	24.7	22
05/11/2009 17:18	3.8	3.2	2.7	0	0	0.1	0	0.1	3.4	3	22	21.5	21.6	24.8	22
06/11/2009 05:18	5	4.3	3.4	0	0	0.1	0	0.2	2.1	3.8	22	21.5	21.7	24.9	21.9
06/11/2009 17:18	4.6	2.3	3	0	0	0.1	0	0.1	2.7	3.5	22	21.3	21.7	24.8	22
07/11/2009 05:18	5.8	3.2	4.1	0	0	0.1	0	0.2	1.4	4	22	21.6	21.7	24.9	21.9
07/11/2009 17:18	5.2	2.6	3.5	0	0	0.1	0	0.1	2	3.4	22	21.3	21.6	24.8	22
08/11/2009 05:18	5	3.2	3.5	0	0	0	0	0.1	2.1	3.8	22	21.5	21.6	24.9	22
08/11/2009 17:18	3	1.2	1.7	0	0	0.1	0	0.1	1.8	4.3	22	21.2	21.6	24.8	22
09/11/2009 05:18	4.7	1.7	2.9	0	0	0.1	0	0.2	1.1	4.6	22	21.6	21.7	24.9	22
09/11/2009 17:18	3	2.1	2.6	0	0	0.1	0	0.1	0.8	4.9	21.9	21.3	21.5	24.9	22
10/11/2009 05:18	4.4	2	3.4	0	0	0	0	0.2	2.1	3.8	22	21.5	21.6	24.9	21.9
10/11/2009 17:18	3.5	0.8	2.1	0	0	0.1	0	0.1	2.4	3.7	22	21.3	21.6	24.8	22
11/11/2009 05:18	5.9	2.7	3.7	0	0	0.1	0.1	0.2	2	3.8	22	21.6	21.7	25	22
11/11/2009 17:18	4.4	2.3	2.7	0	0	0.1	0	0.1	2.1	3.8	22	21.3	21.5	24.8	22
12/11/2009 05:18	5.2	2.9	3.5	0	0	0.1	0	0.2	2	3.8	22	21.5	21.6	24.9	21.9
12/11/2009 17:18	4.1	2.1	2.6	0	0	0.1	0	0.1	1.7	3.7	21.9	21.3	21.5	24.8	22
13/11/2009 05:18	4	3	3.7	0	0	0.1	0	0.2	1.8	4	22	21.6	21.6	24.9	22
13/11/2009 17:18	4.1	2.3	3.8	0	0	0.1	0	0.1	2.1	3.8	21.9	21.3	21.6	24.8	22
14/11/2009 05:18	4.6	3.7	4	0	0	0	0	0.2	2.7	4.4	21.9	21.5	21.6	24.8	22
14/11/2009 17:18	3	2	2.9	0	0	0	0	0.1	2.1	5.3	21.8	21.3	21.6	24.8	22
15/11/2009 05:19	3.7	2.6	4.4	0	0	0.1	0.1	0.2	2.3	4	21.9	21.5	21.6	24.9	22
15/11/2009 17:19	3	1.8	2.7	0	0	0	0	0.3	3	3.8	21.8	21.3	21.6	24.8	22
16/11/2009 05:19	4	3.2	3.5	0	0	0	0	0.2	3	4.6	21.8	21.4	21.6	24.8	21.9
16/11/2009 17:19	4	3.5	3.7	0	0	0.1	0.1	0.1	2.3	4.9	21.9	21.3	21.6	24.8	22
17/11/2009 05:19	4.7	2.7	3.5	0	0	0.1	0	0.2	1.7	3.7	22	21.5	21.6	24.9	22
17/11/2009 17:19	4.4	1.5	3	0	0	0.1	0	0.1	2.3	4	22	21.3	21.6	24.8	22
18/11/2009 05:19	5.3	2.6	3.7	0	0	0	0	0.2	2.1	4.3	22	21.5	21.6	24.8	21.8
18/11/2009 17:19	4.6	2	3	0	0	0.1	0	0.1	2.4	4	22	21.3	21.6	24.8	21.9
19/11/2009 05:19	5.2	3.4	3.2	0	0	0	0	0.2	2.4	5	21.9	21.4	21.6	24.7	21.8
19/11/2009 17:19	5.2	3.2	4.4	0	0	0.1	0	0.1	2.4	3.8	21.9	21.2	21.5	24.7	21.9
20/11/2009 05:19	5.6	2.7	2.3	0	0	-0.1	0	0.2	2.7	4	22	21.5	21.6	24.8	21.9
20/11/2009 17:19	2	2.1	2.1	0	0	0.1	0.1	0.1	2.1	4	22	21.2	21.6	24.7	21.9
21/11/2009 05:19	5.6	2.6	4.1	0	0	0	0	0.1	2	4.3	22	21.4	21.6	24.8	21.9
21/11/2009 17:19	4.3	2.3	3.2	0	0	0	0	0.1	1.4	4.6	22	21.3	21.6	24.7	21.9
22/11/2009 05:19	5.9	3.4	4	0	0	0.1	0	0.2	1.8	4.4	22	21.5	21.6	24.8	22
22/11/2009 17:19	5.8	2.9	3.5	0	0	0	0	0.1	2.3	4	22	21.4	21.6	24.8	22
23/11/2009 05:19	5.6	4.6	3.7	0	0	0	0	0.2	2.4	4.1	22	21.5	21.6	24.8	22
23/11/2009 17:19	4	2	3.7	0	0	0.1	0.1	0.1	2.3	4.1	22	21.4	21.6	24.8	22

Time/Date	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	Channel 9	Channel 10	Channel 11	Channel 12	Channel 13	Channel 14	Channel 15
24/11/2009 05:19	4.7	3.2	3.5	0	0	0	0	0.2	2.4	4.7	22	21.5	21.6	24.8	21.8
24/11/2009 17:19	5.3	2.6	3.5	0	0	0	0	0.2	2	4.3	22	21.3	21.6	24.8	21.8
25/11/2009 05:19	6.1	3.4	4.1	0	0	0.1	0	0.2	2.6	4	22	21.5	21.6	24.8	21.9
25/11/2009 17:19	4.1	2.4	2.7	0	0	0.1	0	0.1	1.8	4.4	22	21.3	21.6	24.9	22
26/11/2009 05:19	5.6	3.4	4	0	0	0.1	0	0.3	2.3	4.1	22	21.6	21.6	24.9	21.6
26/11/2009 17:19	4.3	1.7	2.6	0	0	0.1	0	0.1	1.8	3.8	22	21.4	21.6	24.9	22
27/11/2009 05:19	5.3	3.2	1.8	0	0	0	0	0.3	2.6	4.9	22	21.6	21.6	24.9	21.7
27/11/2009 17:19	5.5	3.8	3.4	0	0	0.1	0	0.2	2.9	4.4	22	21.4	21.6	24.9	22
28/11/2009 05:19	6.3	3.5	4	0	0	0.1	0	0.2	2.1	4	22	21.5	21.7	24.9	22
28/11/2009 17:20	6.3	2.4	3.7	0	0	0.1	0	0.2	2.4	4.7	22	21.5	21.7	24.9	22
29/11/2009 05:20	7.8	3.4	4.7	0	0	0.1	0.1	0.2	2.6	5.6	22	21.6	21.6	25	22
29/11/2009 17:20	7	2.6	4.1	0	0	0.1	0	0.2	2.3	5.2	22	21.5	21.7	25	22
30/11/2009 05:20	5.6	2.9	3.8	0	0	0.1	0	0.2	2	3.8	22	21.6	21.7	25	22
01/12/2009 06:38	5.9	2.6	3.4	0	0	0.1	0.1	0.3	2.3	4	22	21.6	21.7	25	22
01/12/2009 18:38	5.6	2.7	3.2	0	0	0.1	0	0.2	2.4	4.7	22.1	21.4	21.6	24.8	22
02/12/2009 06:38	5.8	4.9	3.7	0	0	0.1	0	0.2	2.4	4	22	21.5	21.6	24.8	22
02/12/2009 18:38	5.2	2.6	1.8	0	0	0.1	0	0.1	2.4	4.3	22	21.3	21.6	24.8	22
03/12/2009 06:38	6.3	2.6	2.7	0	0	0.1	0	0.1	2.3	4	22	21.6	21.7	24.9	22
03/12/2009 18:38	5.2	2.1	3.4	0	0	0.1	0	0.2	2	3.7	22.1	21.5	21.7	24.9	21.9
04/12/2009 06:38	5.2	3.4	3.2	0	0	0.1	0	0.1	2.1	4.6	22	21.6	21.7	24.9	22
04/12/2009 18:38	5.6	2.6	3.7	0	0	0	0	0.1	3.5	3.8	22	21.3	21.6	24.7	21.9
05/12/2009 06:38	5.9	3.8	3.8	0	0	0	0	0.1	2.3	4.7	22	21.5	21.6	24.8	21.9
05/12/2009 18:38	6.7	2.9	4.3	0	0	0	0	0.2	3	5.2	22	21.3	21.5	24.7	21.9
06/12/2009 06:39	6.1	5	3.8	0	0	0.1	0	0.2	2.3	4.6	22	21.5	21.7	24.8	21.9
06/12/2009 18:39	6.4	2.1	3.7	0	0	0	0	0.2	2.1	5.6	22	21.5	21.7	24.8	22
07/12/2009 06:39	6.3	4	3.5	0	0	0	0	0.2	2.9	5.8	22	21.5	21.6	24.8	21.9
07/12/2009 18:39	4.6	3.2	3.5	0	0	0.1	0	0.2	2.3	5	22.1	21.5	21.7	24.9	22
08/12/2009 06:39	5.6	3	3	0	0	0	0	0.3	2.3	5.5	22	21.6	21.7	24.9	21.9
08/12/2009 18:39	4.9	3	3.4	0	0	0	0	0.2	3.2	4.9	22	21.4	21.6	24.8	21.9
09/12/2009 06:39	5	2.6	2.3	0	0	0	0	0.2	2.1	4.6	22	21.5	21.6	24.8	21.8
09/12/2009 18:39	4.6	3.5	3.2	0	0	0.1	0	0.2	2.7	4.1	22.1	21.4	21.7	24.8	21.9
10/12/2009 06:39	5	2	3.4	0	0	0.1	0.1	0.1	2.3	4	22.1	21.6	21.7	25	22
10/12/2009 18:39	4.3	1.4	2.6	0	0	0.1	0.1	0.1	2	4.4	22.1	21.4	21.7	24.9	21.9
11/12/2009 06:39	4	1.8	2.9	0	0	0	0	0.2	3	4.9	22.1	21.5	21.7	24.9	21.9
11/12/2009 18:39	4.4	1.1	2	0	0	0.1	0.1	0.1	2.4	4.1	22.1	21.3	21.7	24.9	21.9
12/12/2009 06:39	5.6	2	2.9	0	0	0.1	0	0.1	1.7	4.1	22.1	21.6	21.7	24.9	22
12/12/2009 18:39	4.9	0.9	2.7	0	0	0.1	0	0.1	2.3	5	22.1	21.4	21.8	24.9	22
13/12/2009 06:39	5.3	2.6	2.7	0	0	0.1	0.1	0.1	2.7	3.8	22.1	21.6	21.8	25	22
13/12/2009 18:39	5.2	0.9	2.6	0	0	0.1	0	0.1	2	4	22.1	21.5	21.8	25	22
14/12/2009 06:39	5.8	2.3	1.8	0	0	0.1	0.1	0.2	3.5	4.1	22.1	21.6	21.8	25	22

Time/Date	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8	Channel 9	Channel 10	Channel 11	Channel 12	Channel 13	Channel 14	Channel 15
14/12/2009 18:39	4	1.8	3.7	0	0	0.1	0	0.1	1.8	4	22.1	21.5	21.7	25	22
15/12/2009 06:39	4.4	4.4	2.7	0	0	0.1	0	0.1	2.6	4.1	22.1	21.6	21.6	24.9	22
15/12/2009 18:39	5.3	3.2	2	0	0	0.1	0	0.1	1.8	4.1	22.1	21.4	21.7	24.8	22
16/12/2009 06:39	5.9	4	4.6	0	0	0.1	0	0.1	2.1	4	22	21.6	21.7	24.9	22
16/12/2009 18:39	5	2	4	0	0	0.1	0.1	0.1	1.5	4.7	22.1	21.5	21.7	24.9	22
17/12/2009 06:39	4.6	2.6	3.4	0	0	0.1	0	0.1	2.1	3.8	22.1	21.6	21.7	25	22
17/12/2009 18:39	3.4	2.3	3.4	0	0	0.1	0.1	0.1	2	4.4	22.1	21.5	21.8	25	22
18/12/2009 06:39	4	2.6	3.8	0	0	0.1	0.1	0.1	2.6	4.4	22.1	21.6	21.7	25	22
18/12/2009 18:39	5.2	1.2	2.9	0	0	0.1	0.1	0.2	2.4	4	22.1	21.5	21.8	25	22.1
19/12/2009 06:39	6.3	2.9	5	0	0	0.2	0.1	0.2	2.3	3.8	22	21.6	21.8	25	22
19/12/2009 18:39	5.3	2	3.4	0	0	0.1	0	0.2	2.1	5.2	22.1	21.4	21.8	24.9	22
20/12/2009 06:40	6.9	3.2	3.8	0	0	0.1	0	0.2	2.3	4.3	22	21.6	21.8	25	22
20/12/2009 18:40	6.9	2.3	4	0	0	0.1	0	0.2	1.8	4.1	22	21.5	21.8	25	21.9
21/12/2009 06:40	6.9	3.2	4.6	0	0	0.1	0.1	0.2	2.1	4.4	22	21.6	21.7	25	21.9
21/12/2009 18:40	6.4	2.6	4.6	0	0	0.1	0	0.1	2.6	4	22	21.4	21.8	24.8	22
22/12/2009 06:40	7.6	3.7	4.3	0	0	0.1	0.1	0.2	1.8	4.1	22	21.6	21.7	25	21.9
22/12/2009 18:40	7.6	2.7	3.7	0	0	0.1	0.1	0.1	2.3	4.1	22	21.4	21.8	24.9	22
23/12/2009 06:40	7.5	3	4.6	0	0.1	0.1	0.1	0.2	3.2	5	22	21.6	21.7	25	22
23/12/2009 18:40	6.6	2.6	4	0	0	0.1	0.1	0.2	2.3	4	22.1	21.5	21.8	25	22
24/12/2009 06:40	7.3	3.5	4.9	0	0	0.1	0.1	0.2	2.3	4.1	22	21.6	21.7	25	22
24/12/2009 18:40	6.9	2.6	5	0	0	0.1	0	0.2	2.6	4.3	22	21.5	21.8	25	21.9
25/12/2009 06:40	7.9	3.5	7.2	0	0.1	0.2	0.1	0.2	2	4.7	22	21.6	21.7	25	22
25/12/2009 18:40	6.6	2.3	4.9	0	0	0.1	0	0.3	1.8	4.1	22	21.5	21.7	25	21.9
26/12/2009 06:40	7	3.5	4.6	0	0	0.1	0.1	0.3	2.6	4.3	22	21.5	21.8	25	21.9
26/12/2009 18:40	6.7	2.6	4.6	0	0	0.1	0	0.2	2.6	6.6	22	21.4	21.8	24.9	21.8
27/12/2009 06:40	6.9	2.7	4.3	0	0	0.1	0.1	0.1	1.7	4.3	22	21.5	21.8	24.9	22
27/12/2009 18:40	6.4	2.1	4.1	0	0	0.1	0.1	0.1	2.3	3.8	22.1	21.4	21.8	24.9	21.9
28/12/2009 06:40	6.7	3	4.9	0	0.1	0.1	0.1	0.2	2.7	5	22	21.6	21.7	25	22
28/12/2009 18:40	6.9	2.3	4.9	0	0	0.1	0.1	0.2	2.3	4.3	22	21.5	21.7	25	22
29/12/2009 06:40	6.6	3.5	4.3	0	0	0.1	0	0.1	2.1	5.2	22	21.5	21.6	25	22
29/12/2009 18:40	8.5	3	5.5	0	0	0.1	0	0.2	1.7	5.2	22	21.5	21.6	25	21.9
30/12/2009 06:40	7.6	3.7	3	0	0	0.1	0	0.2	3.2	4.6	22	21.5	21.7	25	22
30/12/2009 18:40	8.8	3	5.2	0	0	0.1	0.1	0.2	2.6	4.7	22	21.5	21.8	24.9	22
31/12/2009 06:40	7.5	3.7	4	0	0	0.1	0.1	0.2	2.7	4.3	22	21.5	21.8	24.9	22
31/12/2009 18:40	6.6	1.8	3.4	0	0	0.1	0.1	0.2	3.2	4.7	22.1	21.5	21.8	25	22

APPENDIX 4 SURFACE WATER MONITORING RESULTS

2009 Quarterly Surface Water Monitoring

		SW1	SW2a	SW3a	SW4	SW5
		WST-W0074-02-SW1	WST-W0074-02-SW2a	WST-W0074-02-SW3a	WST-W0074-02-SW4	WST-W0074-02-SW5
Dis Oxygen Q1	%Sat	97	100	100	87	120
Dis Oxygen Q2	%Sat	76	85	80	78	141
Dis. Oxygen Q3	%Sat	75	69	78	80	92
Dis. Oxygen Q4	%Sat	81	76	82	78	62
median		78.5	80.5	81	79	106

		SW1	SW2a	SW3a	SW4	SW5
		WST-W0074-02-SW1	WST-W0074-02-SW2a	WST-W0074-02-SW3a	WST-W0074-02-SW4	WST-W0074-02-SW5
pH Q1	pH	8	8	8.2	7.8	9.4
pH Q2	pH	7.6	7.7	7.9	7.5	7.1
pH Q3	pH	7.6	7.5	7.6	7.4	8
pH Q4	pH	7.8	7.7	7.8	7.8	7.8
median		7.7	7.7	7.85	7.65	7.9

		SW1	SW2a	SW3a	SW4	SW5
		WST-W0074-02-SW1	WST-W0074-02-SW2a	WST-W0074-02-SW3a	WST-W0074-02-SW4	WST-W0074-02-SW5
Cond @25°C Q1	uS/cm	718	723	723	723	225
Cond @25°C Q2	uS/cm	550	602	547	514	136
Cond. @25°C Q3	µS/cm	523	520	523	595	120
Cond. @25°C Q4	µS/cm	629	636	641	584	255
median		589.5	619	594	589.5	180.5

		SW1	SW2a	SW3a	SW4	SW5
		WST-W0074-02-SW1	WST-W0074-02-SW2a	WST-W0074-02-SW3a	WST-W0074-02-SW4	WST-W0074-02-SW5
Ammonia Q1	mg/lN	0.083	0.093	0.11	0.094	0.015
Ammonia Q2	mg/lN	0.079	0.061	0.053	0.091	0.02
Ammonia Q3	mg/lN	0.11	0.09	0.06	0.2	0.62
Ammonia Q4	mg/lN	0.18	0.17	0.16	0.2	0.57
median		0.0965	0.0915	0.085	0.147	0.295

		SW1	SW2a	SW3a	SW4	SW5
		WST-W0074-02-SW1	WST-W0074-02-SW2a	WST-W0074-02-SW3a	WST-W0074-02-SW4	WST-W0074-02-SW5
Chloride Q1	mg/l Cl	16	16	16	19	23
Chloride Q2	mg/l Cl	12	10	11	10	5
Chloride Q3	mg/l Cl	13	14	14	15	5
Chloride Q4	mg/l Cl	13	13	13	13	6
median		13	13.5	13.5	14	5.5

		SW1	SW2a	SW3a	SW4	SW5
		WST-W0074-02-SW1	WST-W0074-02-SW2a	WST-W0074-02-SW3a	WST-W0074-02-SW4	WST-W0074-02-SW5
BOD Q1	mg/l 02	1.2	0.7	1	1.6	8.3
BOD Q2	mg/l 02	1.8	1	1.8	1.5	11.1
BOD Q3	mg/l 02	3.7	3.8	3.7	3	3.3
BOD Q4	mg/l 02	1.3	1.3	1.1	1.7	1.5
median		1.55	1.15	1.45	1.65	5.8

		SW1	SW2a	SW3a	SW4	SW5
		WST-W0074-02-SW1	WST-W0074-02-SW2a	WST-W0074-02-SW3a	WST-W0074-02-SW4	WST-W0074-02-SW5
COD Q1	mg/l 02	22	20	14	15	31
COD Q2	mg/l 02	34	8	37	10	42
COD Q3	mg/l 02	38	42	42	32	20
COD Q4	mg/l 02	20	20	20	20	20
median		28	20	28.5	17.5	25.5

		SW1	SW2a	SW3a	SW4	SW5
		WST-W0074-02-SW1	WST-W0074-02-SW2a	WST-W0074-02-SW3a	WST-W0074-02-SW4	WST-W0074-02-SW5
Susp. Solids Q1	mg/l	8	8	6	6	6
Susp. Solids Q2	mg/l	13	10	6	6	12
Susp. Solids Q3	mg/l	5	5	5	5	27
Susp. Solids Q4	mg/l	5	5	5	75	5
median		6.5	6.5	5.5	6	9

Location	Date Sampled	Temp	Conductivity	Ammonia	pH
SW1	09/01/2009	5.7	742		0
SW1	16/01/2009	9	575	0.37	0
SW1	23/01/2009	7.1	521	0.22	0
SW1	27/01/2009	9.9	612		0
SW1	03/02/2009	6.2	571		0
SW1	13/02/2009	10.3	652		0
SW1	27/02/2009	10	697		0
SW1	05/03/2009	8.4	650		0
SW1	11/03/2009	12.9	658		7.68
SW1	19/03/2009	9.4	689		0
SW1	20/03/2009	12.4	687		8.09
SW1	27/03/2009		628		7.3
SW1	03/04/2009	10.3	632		7.79
SW1	09/04/2009	10.8	722		7.47
SW1	16/04/2009	11.4	683		8.07
SW1	24/04/2009	12.4	602		7.9
SW1	29/04/2009	11.9	622		7.77
SW1	08/05/2009	12.8	682		8.03
SW1	13/05/2009	11.7	724		7.67
SW1	22/05/2009	14.3	612		7.89
SW1	28/05/2009	22.4	672		7.58
SW1	03/06/2009	21.1	714		7.7
SW1	12/06/2009	18.5	707		7.77
SW1	23/06/2009	20.2	730		7.98
SW1	02/07/2009	18.1	686		7.53
SW1	09/07/2009	22.8	585		7.52
SW1	15/07/2009	20.5	592		7.65
SW1	24/07/2009	14.2	581		7.54
SW1	07/08/2009	15.8	710		7.69
SW1	13/08/2009	19.6	723		7.62
SW1	17/08/2009	17.3	752		7.76
SW1	24/08/2009	15.8	737		7.91
SW1	04/09/2009	14.9	717		7.64
SW1	07/09/2009	16.9	640		7.56
SW1	15/09/2009	14.5	732		7.63
SW1	23/09/2009	13	745		7.76
SW1	02/10/2009	16.1	770		7.72
SW1	09/10/2009	14	602		7.52
SW1	15/10/2009	14.2	680		7.71
SW1	22/10/2009	13.1	692		7.67
SW1	29/10/2009	15.2	693		7.5
SW1	06/11/2009	12.6			7.16
SW1	10/11/2009	11.2	346		6.97
SW1	17/11/2009	10.8	369		7.09
SW1	27/11/2009	8.1	342		7.11
SW1	30/11/2009	8.7	631		7.11
SW1	11/12/2009	9.2	614		7.14
SW1	17/12/2009	8.3	663		7.83
SW1	23/12/2009	5.1	744		7.41
Median		12.7	676	0.295	7.58
Min		5.1	342	0.22	0

Max		22.8	770	0.37	8.09
Location	Date Sampled	Temp	Conductivity	Ammonia	pH
SW2A	09/01/2009	5.9	773		0
SW2A	16/01/2009	8.2	580	0.37	0
SW2A	23/01/2009	5.4	529	0.21	0
SW2A	27/01/2009	9.8	608		0
SW2A	03/02/2009	6.3	567		0
SW2A	13/02/2009	10.4	681		0
SW2A	27/02/2009	9.4	704		0
SW2A	05/03/2009	7	646		0
SW2A	11/03/2009	11.4	666		7.81
SW2A	19/03/2009	9.7	694		0
SW2A	20/03/2009	12.3	682		8.16
SW2A	27/03/2009		639		7.33
SW2A	03/04/2009	10.2	641		7.82
SW2A	09/04/2009	10.9	735		7.52
SW2A	16/04/2009	10.8	680		7.93
SW2A	24/04/2009	12.2	606		7.87
SW2A	29/04/2009	11.9	624		7.78
SW2A	08/05/2009	12.9	687		8.04
SW2A	13/05/2009	10.5	724		7.8
SW2A	22/05/2009	14.1	619		8
SW2A	28/05/2009	15.7	668		7.6
SW2A	03/06/2009	21.6	712		7.73
SW2A	12/06/2009	18.3	706		7.78
SW2A	23/06/2009	19.9	728		7.87
SW2A	02/07/2009	17.8	685		7.52
SW2A	09/07/2009	16.6	580		7.85
SW2A	15/07/2009	17.7	587		7.48
SW2A	24/07/2009	14.5	559		7.65
SW2A	07/08/2009	15.6	716		7.66
SW2A	13/08/2009	17.7	704		7.77
SW2A	17/08/2009	16.6	745		7.8
SW2A	24/08/2009	15.2	734		7.96
SW2A	04/09/2009	15.1	702		7.7
SW2A	07/09/2009	15.8	656		7.59
SW2A	15/09/2009	14.4	725		7.76
SW2A	23/09/2009	13.5	366		8.13
SW2A	02/10/2009	158	766		7.7
SW2A	09/10/2009	13.6	598		7.49
SW2A	15/10/2009	14	714		7.81
SW2A	22/10/2009	12.9	715		7.72
SW2A	29/10/2009	14.6	694		7.37
SW2A	06/11/2009	12.7	459		7.12
SW2A	10/11/2009	9.3	348		6.93
SW2A	17/11/2009	11.1	351		7.01
SW2A	27/11/2009	8.5	329		7.21
SW2A	30/11/2009	8.6	626		7.12
SW2A	11/12/2009	9.1	610		7.17
SW2A	17/12/2009	8	677		7.61
SW2A	23/12/2009	4.9	736		7.65
Median		12.5	677	0.29	7.65

Min		4.9	329	0.21	0
Max		158	773	0.37	8.16
Location	Date Sampled	Temp	Conductivity	Ammonia	pH
SW3A	09/01/2009	5.8	710		0
SW3A	16/01/2009	9.4	577	0.35	0
SW3A	23/01/2009	5.8	516	0.19	0
SW3A	27/01/2009	10.3	591		0
SW3A	03/02/2009	6.3	536		0
SW3A	13/02/2009	10.3	681		0
SW3A	27/02/2009	9.8	711		0
SW3A	05/03/2009	7.5	633		0
SW3A	11/03/2009	13	658		7.95
SW3A	19/03/2009	9.7	670		0
SW3A	20/03/2009	12.6	684		8.05
SW3A	27/03/2009		622		6.95
SW3A	03/04/2009	10.5	630		7.67
SW3A	09/04/2009	11	732		7.5
SW3A	16/04/2009	10.9	680		7.9
SW3A	24/04/2009	12.9	645		7.86
SW3A	29/04/2009	12.8	637		7.85
SW3A	08/05/2009	12.6	701		8.1
SW3A	13/05/2009	11.9	688		7.82
SW3A	22/05/2009	13.4	637		8.02
SW3A	28/05/2009	17.8	675		7.88
SW3A	03/06/2009	20.8	723		7.84
SW3A	12/06/2009	20.2	703		7.88
SW3A	23/06/2009	20.5	733		8.05
SW3A	02/07/2009	18	683		7.58
SW3A	09/07/2009	18.3	552		7.91
SW3A	15/07/2009	18.8	616		7.4
SW3A	24/07/2009	14.9	572		7.67
SW3A	07/08/2009	16.8	731		7.53
SW3A	13/08/2009	18	728		7.91
SW3A	17/08/2009	18	733		7.87
SW3A	24/08/2009	16.1	706		7.98
SW3A	04/09/2009	15.5	714		7.73
SW3A	07/09/2009	17.1	660		7.59
SW3A	15/09/2009	14.7	732		7.82
SW3A	23/09/2009	13	742		7.42
SW3A	02/10/2009	16.5	674		7.87
SW3A	09/10/2009	14.9	558		7.56
SW3A	15/10/2009	14.6	682		7.74
SW3A	22/10/2009	13	695		7.7
SW3A	29/10/2009	15.8	652		7.58
SW3A	06/11/2009	12.6	514		7.43
SW3A	10/11/2009	10	336		7.08
SW3A	17/11/2009	11.4	476		7.02
SW3A	27/11/2009	9	381		7.22
SW3A	30/11/2009	9.5	617		7.81
SW3A	11/12/2009	9.4	607		7.39
SW3A	17/12/2009	8.3	678		8.14
SW3A	23/12/2009	5	729		7.76

Median		12.85	674	0.27	7.67
Min		5	336	0.19	0
Max		20.8	742	0.35	8.14
Location	Date Sampled	Temp	Conductivity	Ammonia	pH
SW4	09/01/2009	5.4	678		0
SW4	16/01/2009	9.6	560	0.46	0
SW4	23/01/2009	6.3	610	0.28	0
SW4	27/01/2009	9.9	540		0
SW4	03/02/2009	5.8	486		0
SW4	13/02/2009	10.6	640		0
SW4	27/02/2009	9.8	694		0
SW4	05/03/2009	8.3	597		0
SW4	11/03/2009	13.2	617		7.73
SW4	19/03/2009	10.1	700		0
SW4	20/03/2009	14.4	691		7.77
SW4	27/03/2009		636		7.21
SW4	03/04/2009	10.8	659		7.34
SW4	09/04/2009	11.1	767		7.68
SW4	16/04/2009	11.1	697		8.12
SW4	24/04/2009	13.4	633		7.66
SW4	29/04/2009	12.9	604		7.72
SW4	08/05/2009	12.7	658		8.04
SW4	13/05/2009	12.1	728		7.44
SW4	22/05/2009	14.9	578		7.81
SW4	28/05/2009	18.1	647		7.87
SW4	03/06/2009	20.9	717		7.66
SW4	12/06/2009	20.1	735		7.56
SW4	23/06/2009	22.1	724		8.08
SW4	02/07/2009	17.9	688		7.2
SW4	09/07/2009	19.1	512		7.59
SW4	15/07/2009	20.2	562		7.38
SW4	24/07/2009	15.1	553		7.6
SW4	07/08/2009	16.4	738		7.51
SW4	13/08/2009	20.1	762		7.67
SW4	17/08/2009	19.1	779		7.61
SW4	24/08/2009	16.6	722		7.73
SW4	04/09/2009	15.7	738		7.62
SW4	07/09/2009	17.6	638		7.42
SW4	15/09/2009	14.8	734		7.54
SW4	23/09/2009	12.5	741		7.26
SW4	02/10/2009	16.7	787		7.7
SW4	09/10/2009	15.2	547		7.38
SW4	15/10/2009	14.8	681		7.27
SW4	22/10/2009	13.4	690		7.46
SW4	29/10/2009	15.9	648		7.3
SW4	06/11/2009	12.8	467		7.1
SW4	10/11/2009	10.7	398		6.88
SW4	17/11/2009	11.2	395		7.06
SW4	27/11/2009	9.1	367		7.18
SW4	30/11/2009	9.7	511		7.15
SW4	11/12/2009	9.6	544		7.22
SW4	17/12/2009	8.4	642		8.25

SW4	23/12/2009				
Median		13.2	647.5	0.37	7.43
Min		5.4	367	0.28	0
Max		22.1	787	0.46	8.25
Location	Date Sampled	Temp	Conductivity	Ammonia	pH
SW5	09/01/2009				0
SW5	16/01/2009	10.1	201	2.1	0
SW5	23/01/2009	4.9	198	1.59	0
SW5	27/01/2009				0
SW5	03/02/2009	7.4	196		0
SW5	13/02/2009				0
SW5	27/02/2009				0
SW5	05/03/2009	9.1	194		0
SW5	11/03/2009	15.3	215		8.72
SW5	19/03/2009				0
SW5	20/03/2009	14.2	213		8.67
SW5	27/03/2009		125		7.27
SW5	03/04/2009	12.2	328		8.06
SW5	09/04/2009	11.3	245		8.32
SW5	16/04/2009	11.6	208		9.22
SW5	24/04/2009	15	186		9.01
SW5	29/04/2009	13	194		8.64
SW5	08/05/2009	15.5	192		9.05
SW5	13/05/2009	13.1	163		8.9
SW5	22/05/2009	15.3	227		8.76
SW5	28/05/2009	20.3	162		8.61
SW5	03/06/2009	27.2	138		8.69
SW5	12/06/2009	22.6	176		7.87
SW5	23/06/2009	24.6	177		8.4
SW5	02/07/2009	21.3	182		8367
SW5	09/07/2009	20.9	140		8.95
SW5	15/07/2009	23.2	138		8.66
SW5	24/07/2009	16.6	124		8.72
SW5	07/08/2009	20.3	179		8.86
SW5	13/08/2009	23.2	176		8.3
SW5	17/08/2009	20.8	166		8.43
SW5	24/08/2009	19.2	155		9.07
SW5	04/09/2009	16.3	141		7.79
SW5	07/09/2009	18.1	155		8.81
SW5	15/09/2009	16.8	210		8.49
SW5	23/09/2009				
SW5	02/10/2009				
SW5	09/10/2009	16	158		7.87
SW5	15/10/2009	14.9	137		9.12
SW5	22/10/2009	14.1	147		8.43
SW5	29/10/2009	16.1	128		8.47
SW5	06/11/2009	12	176		7.92
SW5	10/11/2009	9.9	197		6.99
SW5	17/11/2009	9.7	183		8.61
SW5	27/11/2009	8	256		7.02
SW5	30/11/2009	7.7	256		7.09
SW5	11/12/2009	8.4	294		7.49

SW5	17/12/2009	4.8	355		7.53
SW5	23/12/2009				
Median		15.15	182	1.845	8.415
Min		4.8	124	1.59	0
Max		27.2	355	2.1	8367
Location	Date Sampled	Temp	Conductivity	Ammonia	pH
SW7	09/01/2009				0
SW7	16/01/2009				0
SW7	23/01/2009	4.5	406	0.1	0
SW7	27/01/2009				0
SW7	03/02/2009				0
SW7	13/02/2009				0
SW7	27/02/2009				0
SW7	05/03/2009				0
SW7	11/03/2009				
SW7	19/03/2009				0
SW7	20/03/2009				
SW7	27/03/2009				
SW7	03/04/2009				
SW7	09/04/2009				
SW7	16/04/2009				
SW7	24/04/2009				
SW7	29/04/2009	12.8	181		8.7
SW7	08/05/2009				
SW7	13/05/2009				
SW7	22/05/2009				
SW7	28/05/2009				
SW7	03/06/2009				
SW7	12/06/2009				
SW7	23/06/2009				
SW7	02/07/2009				
SW7	09/07/2009				
SW7	15/07/2009				
SW7	24/07/2009				
SW7	07/08/2009				
SW7	13/08/2009				
SW7	17/08/2009				
SW7	24/08/2009				
SW7	04/09/2009	15.1	217		7.67
SW7	07/09/2009				
SW7	15/09/2009				
SW7	23/09/2009				
SW7	02/10/2009				
SW7	09/10/2009	16.2	371		9.09
SW7	15/10/2009				
SW7	22/10/2009	14.3	322		8.77
SW7	29/10/2009				
SW7	06/11/2009	121.4	264		8.42
SW7	10/11/2009				
SW7	17/11/2009				
SW7	27/11/2009				0
SW7	30/11/2009				

SW7	11/12/2009				0
SW7	17/12/2009				
SW7	23/12/2009				
Median		14.7	293	0.1	0
Min		4.5	181	0.1	0
Max		121.4	406	0.1	9.09
Location	Date Sampled	Temp	Conductivity	Ammonia	pH
SW8	09/01/2009				0
SW8	16/01/2009				0
SW8	23/01/2009				0
SW8	27/01/2009				0
SW8	03/02/2009				0
SW8	13/02/2009				0
SW8	27/02/2009				0
SW8	05/03/2009				0
SW8	11/03/2009				
SW8	19/03/2009				0
SW8	20/03/2009				
SW8	27/03/2009				
SW8	03/04/2009				
SW8	09/04/2009				
SW8	16/04/2009				
SW8	24/04/2009				
SW8	29/04/2009				
SW8	08/05/2009				
SW8	13/05/2009				
SW8	22/05/2009				
SW8	28/05/2009				
SW8	03/06/2009				
SW8	12/06/2009				
SW8	23/06/2009				
SW8	02/07/2009				
SW8	09/07/2009				
SW8	15/07/2009				
SW8	24/07/2009				
SW8	07/08/2009				
SW8	13/08/2009				
SW8	17/08/2009				
SW8	24/08/2009				
SW8	04/09/2009				
SW8	07/09/2009				
SW8	15/09/2009	18.8	348		9.07
SW8	23/09/2009				
SW8	02/10/2009				
SW8	09/10/2009	16.4	305		8.67
SW8	15/10/2009	16.3	173		9.4
SW8	22/10/2009	14.4	297		8.23
SW8	29/10/2009	15.8	230		7.55
SW8	06/11/2009	12.3	207		8.11
SW8	10/11/2009	11.9	293	6.95	6.95
SW8	17/11/2009	11.2	310		6.99
SW8	27/11/2009	9.8	329		7.14

SW8	30/11/2009	8.3	291		6.97
SW8	11/12/2009	8.1	302		0
SW8	17/12/2009	8	283		7.11
SW8	23/12/2009				
Median		12.1	295	6.95	6.95
Min		8	173	6.95	0
Max		18.8	348	6.95	9.4

BIOLOGICAL MONITORING OF WATER QUALITY IN THE VICINITY OF DONOHILL LANDFILL, COUNTY TIPPERARY

May 2009

Conservation Services, Tullaha, Glenflesk, Killarney, Co. Kerry
Tel/Fax 064 6630130 e-mail cs@conservation-services.ie

CONTENTS

1. INTRODUCTION

As part of the monitoring of water quality in the vicinity of Donohill Landfill Site, Conservation Services, Ecological & Environmental Consultants have been commissioned by Tipperary S.R. County Council to carry out biological water quality assessment in accordance with EPA Q-rating methodology at four locations adjacent to the landfill site. Biological monitoring was most recently carried out by Conservation Services in October 2008 (Conservation Services October 2008).

Sampling was carried out on 22nd May 2009.

2. METHODOLOGY

2.1. SITE LOCATIONS

Biological sampling and water quality assessment was carried out at the following sites specified by Tipperary S.R. County Council. Grid references were recorded at all sites using a GPS.

SITE	GRID REFERENCE (GPS)
Site SW4	R 9143 4086
Site SW1	R 9076 4255
Site SW2A	R 9046 4263
Site SW 3A	R 9070 4293

The location of the sites is shown on Map 1.

2.2. HABITAT ASSESSMENT

Habitat assessment was carried out at each of the four sites selected for invertebrate/water quality assessment. These sites were assessed in terms of:

- Stream width and depth
- Substrate type, listing substrate fractions in order of dominance, i.e. large rocks, cobble, gravel, sand, mud etc.
- Flow type, listing percentage of riffle, glide and pool in the sampling area

- Instream vegetation, listing plant species occurring and their percentage coverage of the stream bottom at the sampling site

- Dominant bankside vegetation, listing the main species overhanging the stream

- Estimated summer cover by bankside vegetation, giving percentage shade of the sampling site

- Rating of the site as habitat for trout adult, nursery and spawning on a scale of Poor/Fair/Good/Very Good/Excellent. This rating assesses the physical suitability of the habitat; the presence/absence/density of salmonids at the site will also depend on present and historical water quality and accessibility of the site to fish.

2.3. INVERTEBRATE SAMPLING AND WATER QUALITY ASSESSMENT

A kick and stone wash invertebrate sample was taken at each site (ISO 7828:1985) using standard methodology employed by EPA. Each sample was retained in a large plastic bag at the sampling site. Sample processing and preservation was carried out under laboratory conditions within 24 hours of sampling. Mud was removed from each sample by sieving under running water through a 500µ sieve. Sieved samples were then live sorted for 30 minutes in a white plastic sorting tray under a bench lamp (ISO 5667-3:1994) and if necessary using a magnifying lens. Macroinvertebrates were stored in 70% alcohol. Preserved invertebrates were identified to the level required for the EPA Q-rating method (McGarrigle *et al*, 2002) using high-power and low-power binocular microscopes when necessary. The preserved samples were archived for future examination or verification. Based on the relative abundance of indicator species, a biotic index (Q-rating) was determined for each site in accordance with the biological assessment procedure used by the Environmental Protection Agency (Statutory Instruments No. 258 of 1998) and

more detailed unpublished methodology (McGarrigle, Clabby and Lucey pers. comm.)

Biotic Index	Water Quality	Quality Status
Q5	Good	Unpolluted Waters
Q4-5	Fair - Good	
Q4	Fair	
Q3-4	Doubtful - Fair	Slightly Polluted Waters
Q3	Doubtful	Moderately Polluted Waters
Q2-3	Poor - Doubtful	
Q2	Poor	Seriously Polluted Waters
Q1-2	Bad - Poor	
Q1	Bad	

3. RESULTS

Detailed habitat assessment for each sampling site, including aquatic plant assessment, is contained in Appendix 1. Photographs of sampling sites are contained in Appendix 2.

3.1. SITE SW4

The invertebrates recorded at this site merit a Q-rating of Q3 indicating moderately polluted conditions, an improvement compared with Q2 in October 2008. The substantial number of highly pollution tolerant Tubificidae recorded indicate that the improvement in water quality at this site is likely to have been relatively recent.

INDICATOR GROUP	TAXON	May 2009
Group A - Very Pollution Sensitive	None Recorded	
Group B - Moderately Pollution Sensitive	*Baetis muticus*	23
	Nemouridae	5
	Sericostomatidae	1
Group C - Moderately Pollution Tolerant	*Baetis rhodani*	63
	Hydropsychidae	1
	Limnephilidae	4
	Elmidae	1
	Chironomidae (ex. *Chironomus*)	2
	Simuliidae	c.75
	Tipulidae	6
Group D - Very Pollution Tolerant	*Glossiphonia sp.*	2
	Asellus aquaticus	63
Group E - Most Pollution Tolerant	Tubificidae	c.85
Not assigned to any indicator group	Lumbriculidae	c.35

3.2. SITE SW1

The invertebrates recorded at this site merit a Q-rating of Q2-3 indicating moderately polluted conditions, an improvement compared with Q1-2 in October 2008.

INDICATOR GROUP	TAXON	May 2009
Group A - Very Pollution Sensitive	None Recorded	
Group B - Moderately Pollution Sensitive	None recorded	
Group C - Moderately Pollution Tolerant	*Piscicola geometra*	1
	Bithynia tentaculata	16
	Limnephilidae	37
	Gyrinidae	1
	Chironomidae (ex. *Chironomus*)	180
Group D - Very Pollution Tolerant	*Erpobdella octoculata*	2
	Haemopis sanguisuga	1
	Sphaeriidae	1
	Asellus aquaticus	24
Group E - Most Pollution Tolerant	Tubificidae	3

3.3. SITE SW2A

The invertebrate community at this site merits a Q-rating of Q2-3 indicating moderately polluted conditions, an improvement compared with the Q2 assigned in October 2008.

INDICATOR GROUP	TAXON	May 2009
Group A - Very Pollution Sensitive	None Recorded	
Group B - Moderately Pollution Sensitive	None Recorded	
Group C - Moderately Pollution Tolerant	*Piscicola geometra*	1
	Bithynia tentaculata	3
	Limnephilidae	43
	Chironomidae (ex. *Chironomus*)	46
	Simuliidae	1
	Tipulidae	13
	Gyrinidae	1
	Haliplidae	7
Group D - Very Pollution Tolerant	Erpobdellidae	3
	Asellus aquaticus	28
Group E - Most Pollution Tolerant	*Chironomus sp.*	2

3.4. SITE SW3A

The invertebrates recorded at this site merit a Q-rating of Q3 indicating moderately polluted conditions, with no significant change since October 2008.

INDICATOR GROUP	TAXON	May 2009
Group A - Very Pollution Sensitive	*Ecdyonurus sp.*	1
Group B - Moderately Pollution Sensitive	*Baetis muticus*	11
	Sericostomatidae	26
Group C - Moderately Pollution Tolerant	*Gammarus duebeni*	42
	Hydracarina	1
	Baetis rhodani	15
	Glossosomatidae	82
	Hydropsychidae	1
	Limnephilidae	3
	Polycentropodidae	2
	Simuliidae	c.250
	Elmidae	24
	Gyrinidae	3
Group D - Very Pollution Tolerant	Sphaeriidae	2
	Erpobdella octoculata	1
	Glossiphonia sp.	1
	Asellus aquaticus	42
Group E - Most Pollution Tolerant	None recorded	
Taxa not assigned to an indicator group	Lumbricidae	5

4. SUMMARY OF MONITORING RESULTS: Q-RATINGS 2003 - 2009

	Upstream of Landfill		Downstream of landfill	
	SW4	**SW1**	**SW2A**	**SW3A**
March 2003	-	-	-	2-3
June 2004	1-2	2-3	2	2-3
April 2005	1-2	2-3	2-3	2-3
July 2005	2-3/0	2-3/0	2-3	2-3
March 2006	2/0	2-3	2-3	2-3
Nov. 2006	2	2	2	2-3
July 2007	2	2-3/0	2-3	2-3
Sept. 2007	2	2-3	2-3	3
May 2008	2-3	2-3	2-3	3-4
Oct. 2008	2	1-2	2	3
May 2009	3	2-3	2-3	3

5. CONCLUSIONS

Results of biological assessment in May 2009 indicate that the water quality of the Donohill Stream has improved since October 2008 at three of the four sites monitored. At Site SW4, c.2km upstream of the landfill, the water quality has improved from a seriously polluted Q2 to a moderately polluted Q3, which is the best Q-rating recorded at this site since monitoring began in June 2004. The Q-rating at Site SW1 immediately upstream of the landfill had improved from a seriously polluted Q1-2 in October 2008 to a moderately polluted Q2-3. At Site SW2A, just downstream of the landfill, the Q-rating was also Q2-3, having improved from Q2 in October 2008. The Q-rating at Site SW3A, c. 0.5km downstream of the landfill, remained a moderately polluted Q3; no significant change in water quality at the site since October 2008 was indicated.

The results of the biological assessment contain no evidence that the landfill is causing any deterioration in the biological water quality of the stream. This conclusion is based on the assumption that contamination of stream from the landfill cannot take place upstream of Site SW1. As Site SW1 is located immediately adjacent to the landfill, this possibility can only be ruled out on the basis of hydrogeological and surface water drainage assessment. Such assessment does not form part of the biological water quality monitoring brief.

Signed on behalf of Conservation Services

_____

Helena Twomey BA(Mod.) PhD

Date

6. REFERENCES

Conservation Services (October 2008) Biological monitoring of water quality in the vicinity of Donohill Landfill, County Tipperary – October 2008. Report to Tipperary South Riding County Council.

McGarrigle *et al* (2002) Water Quality in Ireland 1998-2000. Environmental Protection Agency.

APPENDIX 1

HABITAT ASSESSMENT AT SAMPLING SITES

Site Code	SW4
Site Location	End of lane, Ballydonagh, c. 2km upstream of landfill
Grid Reference	R9143 4086
Width	1.5m
Depth	8cm
Substrate	Sand, Gravel, Mud
Flow Type	Glide 60% Riffle 40%
Instream Vegetation	None
Dominant Bankside Vegetation	Bramble, Hawthorn, Ash
Summer Cover of Stream by Bankside Vegetation	65%
Salmonid Adult Habitat	None
Salmonid Nursery Habitat	Fair-Poor
Salmonid Spawning Habitat	None-Poor

Site Code	SW 1
Site Location	Just upstream of landfill
Grid Reference	R9076 4255
Width	3m
Depth	65cm
Substrate	Mud
Flow Type	Slow Glide 100%
Instream Vegetation	*Phalaris arundinacea* 10% *Apium nodiflorum* <5% *Rorippa nasturtium-aquaticum* agg. <5% *Sparganium erectum* <5%
Dominant Bankside Vegetation	Hawthorn
Summer Cover of Stream by Bankside Vegetation	25%
Salmonid Adult Habitat	None
Salmonid Nursery Habitat	None
Salmonid Spawning Habitat	None

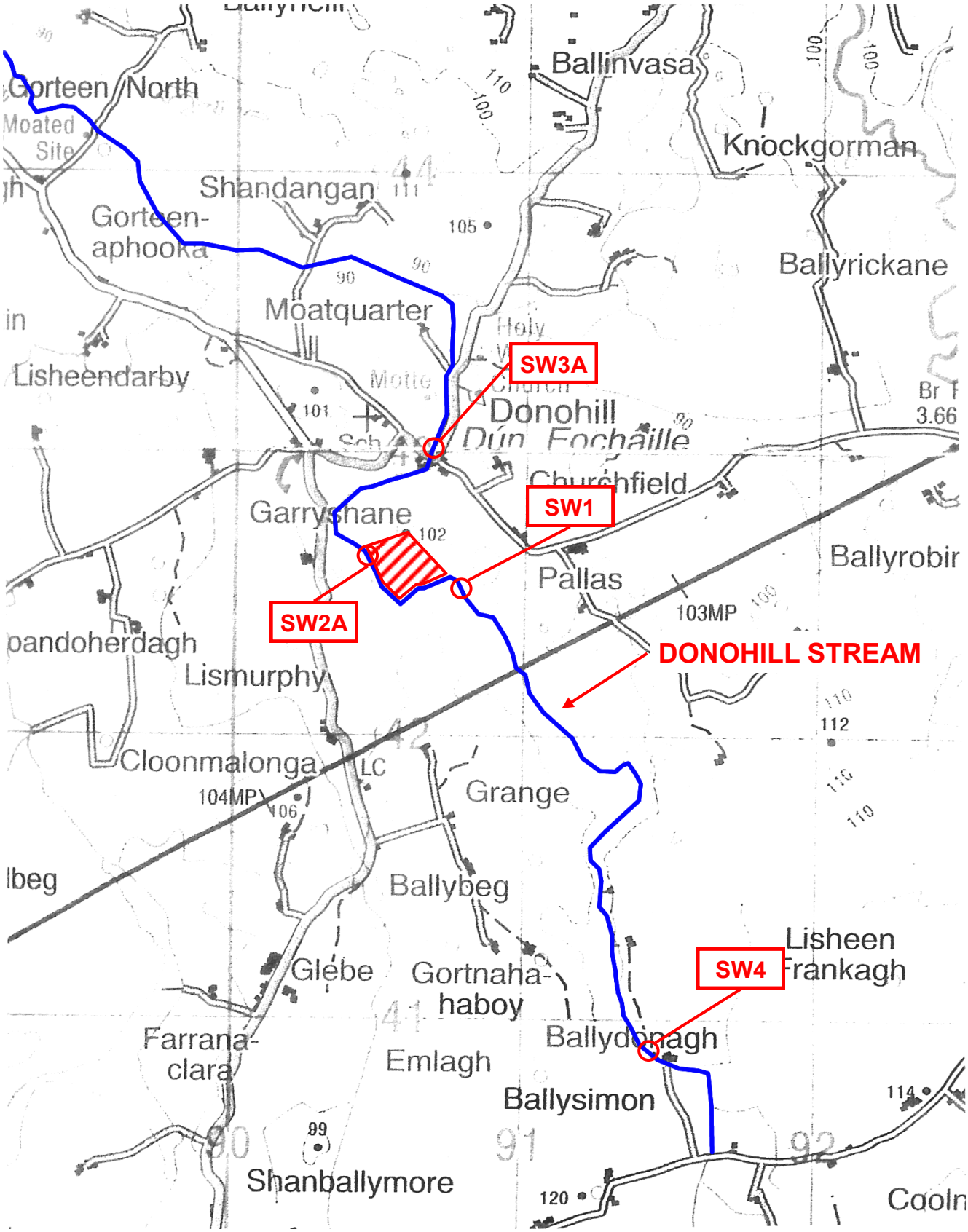
Site Code	SW 2A
Site Location	Just upstream of landfill entrance.
Grid Reference	R 9046 4263
Width	5m
Depth	30cm
Substrate	Mud
Flow Type	Glide 100%
Instream Vegetation	*Callitriche* sp. 15% *Rorippa nasturtium-aquaticum* agg. 15% *Veronica anagallis-aquatica catenata* 5% Filamentous algae 5% *Phalaris arundinacea* <5% *Apium nodiflorum* <5%
Dominant Bankside Vegetation	Nettle, Brambles
Summer Cover of Stream by Bankside Vegetation	10%
Salmonid Adult Habitat	None
Salmonid Nursery Habitat	None
Salmonid Spawning Habitat	None

Site Code	SW 3A
Site Location	Donohill Village d/s bridge
Grid Reference	R 9070 4293
Width	1.5 m
Depth	20 cm
Substrate	Sand, Gravel, Cobble, Mud
Flow Type	Riffle 60% Glide 40%
Instream Vegetation	*Apium nodiflorum* <5% *Phalaris arundinacea* <5%
Dominant Bankside Vegetation	Grasses, Nettle, Bramble
Summer Cover of Stream by Bankside Vegetation	20%
Salmonid Adult Habitat	None
Salmonid Nursery Habitat	Fair
Salmonid Spawning Habitat	Poor

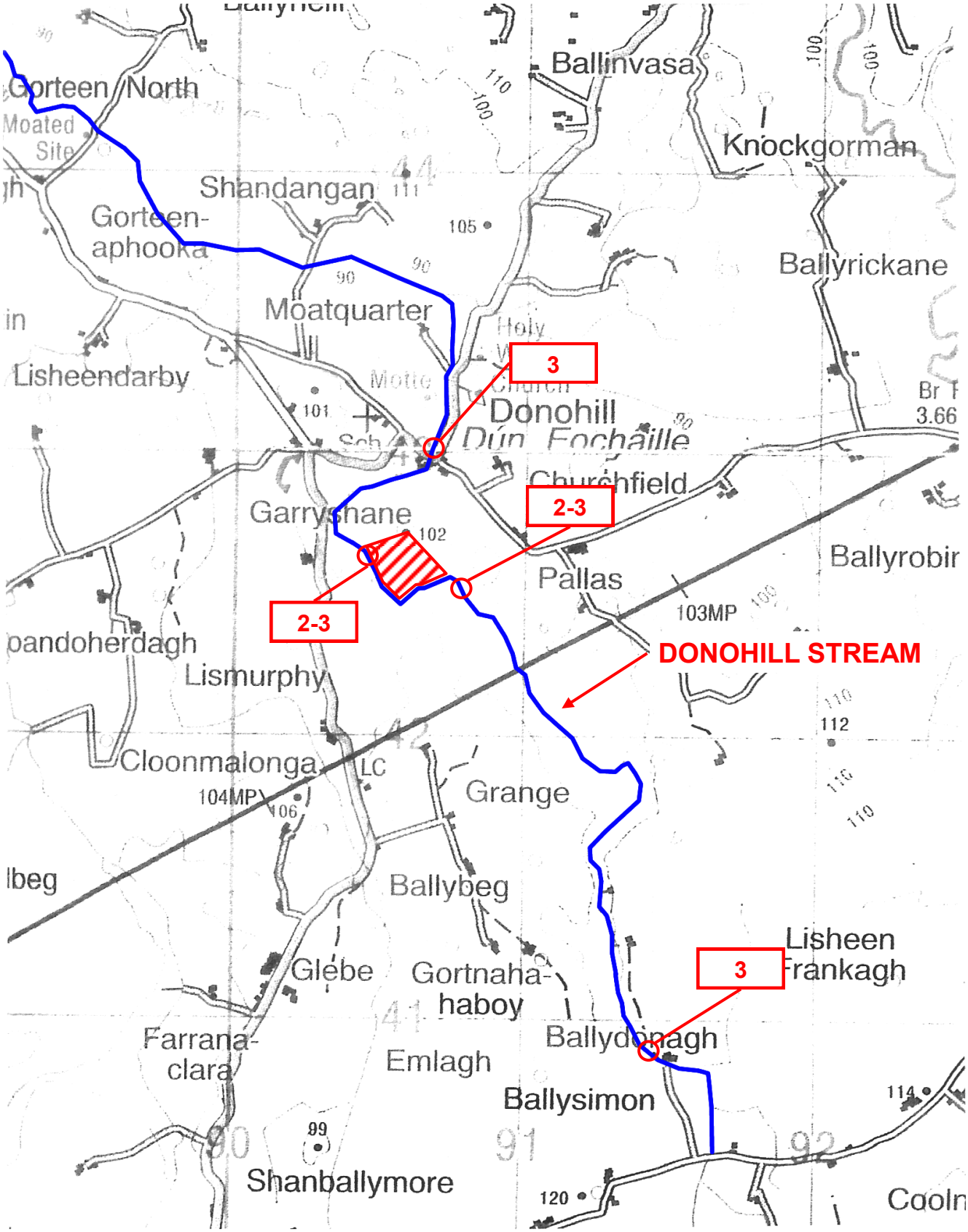
APPENDIX 2

PHOTOGRAPHS

MAP 1 LOCATION OF BIOLOGICAL ASSESSMENT SITES



MAP 2 Q-RATINGS AT BIOLOGICAL ASSESSMENT SITES



BIOLOGICAL MONITORING OF WATER QUALITY IN THE VICINITY OF DONOHILL LANDFILL, COUNTY TIPPERARY

September 2009

Conservation Services, Tullaha, Glenflesk, Killarney, Co. Kerry
Tel/Fax 064 6630130 e-mail cs@conservation-services.ie

CONTENTS

1. INTRODUCTION

As part of the monitoring of water quality in the vicinity of Donohill Landfill Site, Conservation Services, Ecological & Environmental Consultants have been commissioned by Tipperary S.R. County Council to carry out biological water quality assessment in accordance with EPA Q-rating methodology at four locations adjacent to the landfill site. Biological monitoring was most recently carried out by Conservation Services in May 2009 (Conservation Services May 2009).

Sampling was carried out on 11th September 2009.

2. METHODOLOGY

2.1. SITE LOCATIONS

Biological sampling and water quality assessment was carried out at the following sites specified by Tipperary S.R. County Council. Grid references were recorded at all sites using a GPS.

SITE	GRID REFERENCE (GPS)
Site SW4	R 9143 4087
Site SW1	R 9075 4250
Site SW2A	R 9046 4263
Site SW 3A	R 9070 4290

The location of the sites is shown on Map 1.

2.2. HABITAT ASSESSMENT

Habitat assessment was carried out at each of the four sites selected for invertebrate/water quality assessment. These sites were assessed in terms of:

- Stream width and depth
- Substrate type, listing substrate fractions in order of dominance, i.e. large rocks, cobble, gravel, sand, mud etc.
- Flow type, listing percentage of riffle, glide and pool in the sampling area

- Instream vegetation, listing plant species occurring and their percentage coverage of the stream bottom at the sampling site

- Dominant bankside vegetation, listing the main species overhanging the stream

- Estimated summer cover by bankside vegetation, giving percentage shade of the sampling site

- Rating of the site as habitat for trout adult, nursery and spawning on a scale of Poor/Fair/Good/Very Good/Excellent. This rating assesses the physical suitability of the habitat; the presence/absence/density of salmonids at the site will also depend on present and historical water quality and accessibility of the site to fish.

2.3. INVERTEBRATE SAMPLING AND WATER QUALITY ASSESSMENT

A five-minute kick and stone wash sample was taken at each of the four sites (ISO 7828:1985). Each sample was retained in a large plastic bag at the sampling site. Sample processing and preservation was carried out under laboratory conditions within 24 hours of sampling. Mud was removed from each sample by sieving under running water through a 500µ sieve. Sieved samples were then live sorted for 30 minutes in a white plastic sorting tray under a bench lamp (ISO 5667-3:1994) and if necessary using a magnifying lens.

Macroinvertebrates were stored in 70% alcohol. Preserved invertebrates were identified to the level required for the EPA Q-rating method (Clabby *et al,* 2001) using high-power and low-power binocular microscopes when necessary. The preserved samples were archived for future examination or verification. Based on the relative abundance of indicator species, a biotic index (Q-rating) was determined for each site in accordance with the biological assessment procedure used by the Environmental Protection Agency (Statutory Instruments

No. 258 of 1998) and more detailed unpublished methodology (McGarrigle, Clabby and Lucey pers. comm.).

Biotic Index	**EPA Water Quality**	**Water Framework Directive Ecological Status**	**Quality Status**
Q5	Good	High	Unpolluted Waters
Q4-5	Fair - Good	High	
Q4	Fair	Good	
Q3-4	Doubtful - Fair	Moderate	Slightly Polluted Waters
Q3	Doubtful	Poor	Moderately Polluted Waters
Q2-3	Poor - Doubtful	Poor	
Q2	Poor	Bad	Seriously Polluted Waters
Q1-2	Bad - Poor	Bad	
Q1	Bad	Bad	

3. RESULTS

Detailed habitat assessment for each sampling site, including aquatic plant assessment, is contained in Appendix 1. Photographs of sampling sites are contained in Appendix 2.

3.1. SITE SW4

The invertebrates recorded at this site merit a Q-rating of Q1-2 indicating seriously polluted conditions, a deterioration compared with Q3 in May 2009.

INDICATOR GROUP	TAXON	Sept. 2009
Group A - Very Pollution Sensitive	None Recorded	
Group B - Moderately Pollution Sensitive	None Recorded	
Group C - Moderately Pollution Tolerant	Chironomidae (ex. *Chironomus*)	3
Group D - Very Pollution Tolerant	*Asellus aquaticus*	3
Group E - Most Pollution Tolerant	Tubificidae	1
	Chironomus sp.	40

3.2. SITE SW1

The invertebrates recorded at this site merit a Q-rating of Q2-3 indicating moderately polluted conditions, with no significant change since May 2009.

INDICATOR GROUP	TAXON	Sept. 2009
Group A - Very Pollution Sensitive	None Recorded	
Group B - Moderately Pollution Sensitive	None recorded	
Group C - Moderately Pollution Tolerant	*Bithynia tentaculata*	42
	Hydracarina	1
	Chironomidae (ex. *Chironomus*)	36
	Simuliidae	1
Group D - Very Pollution Tolerant	*Glossiphonia complanata*	1
	Erpobdellidae	3
	Helobdella stagnalis	1
	Sphaeriidae	3
Group E - Most Pollution Tolerant	Tubificidae	15

3.3. SITE SW2A

The invertebrate community at this site merits a Q-rating of Q2-3 indicating moderately polluted conditions, with no significant change since May 2009.

INDICATOR GROUP	TAXON	Sept. 2009
Group A - Very Pollution Sensitive	None Recorded	
Group B - Moderately Pollution Sensitive	None Recorded	
Group C - Moderately Pollution Tolerant	Hydracarina	1
	Chironomidae (ex. *Chironomus*)	21
	Simuliidae	c.240
Group D - Very Pollution Tolerant	Erpobdellidae	2
	Glossiphonia complanata	1
	Helobdella stagnalis	1
	Asellus aquaticus	73
Group E - Most Pollution Tolerant	Tubificidae	2

3.4. SITE SW3A

The invertebrates recorded at this site merit a Q-rating of Q3 indicating moderately polluted conditions, with no significant change since May 2009.

INDICATOR GROUP	TAXON	Sept. 2009
Group A - Very Pollution Sensitive	None recorded	
Group B - Moderately Pollution Sensitive	*Baetis muticus*	3
	Sericostomatidae	10
Group C - Moderately Pollution Tolerant	*Gammarus duebeni*	c.150
	Hydracarina	1
	Hydropsychidae	3
	Simuliidae	47
	Tipulidae	1
	Elmidae	4
	Haliplidae	1
Group D - Very Pollution Tolerant	*Erpobdella octoculata*	1
	Glossiphonia sp.	1
	Asellus aquaticus	34
Group E - Most Pollution Tolerant	None recorded	
Taxa not assigned to an indicator group	Lumbricidae	21

4. SUMMARY OF MONITORING RESULTS: Q-RATINGS 2003 - 2009

	Upstream of Landfill		Downstream of landfill	
	SW4	**SW1**	**SW2A**	**SW3A**
March 2003	-	-	-	2-3
June 2004	1-2	2-3	2	2-3
April 2005	1-2	2-3	2-3	2-3
July 2005	2-3/0	2-3/0	2-3	2-3
March 2006	2/0	2-3	2-3	2-3
Nov. 2006	2	2	2	2-3
July 2007	2	2-3/0	2-3	2-3
Sept. 2007	2	2-3	2-3	3
May 2008	2-3	2-3	2-3	3-4
Oct. 2008	2	1-2	2	3
May 2009	3	2-3	2-3	3
Sept. 2009	1-2	2-3	2-3	3

5. CONCLUSIONS

Results of biological assessment in September 2009 indicate that the water quality of the Donohill Stream has not changed significantly since May 2009 at three of the four sites monitored. However, at Site SW4, c.2km upstream of the landfill, the water quality has deteriorated from a moderately polluted Q3 to a seriously polluted Q1-2, more than reversing the improvement recorded at this site in May 2009. The Q-rating at Site SW1 immediately upstream of the landfill remained a moderately polluted Q2-3. At Site SW2A, just downstream of the landfill, the Q-rating also remained at Q2-3. The Q-rating at Site SW3A, c. 0.5km downstream of the landfill, remained a moderately polluted Q3.

The results of the biological assessment contain no evidence that the landfill is causing any deterioration in the biological water quality of the stream. This conclusion is based on the assumption that contamination of stream from the landfill cannot take place upstream of Site SW1. As Site SW1 is located immediately adjacent to the landfill, this possibility can only be ruled out on the basis of hydrogeological and surface water drainage assessment. Such assessment does not form part of the biological water quality monitoring brief.

Signed on behalf of Conservation Services

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Helena Twomey BA(Mod.) PhD

Date

6. REFERENCES

Conservation Services (May 2009) Biological monitoring of water quality in the vicinity of Donohill Landfill, County Tipperary – May 2009. Report to Tipperary South Riding County Council.

McGarrigle *et al* (2002) Water Quality in Ireland 1998-2000. Environmental Protection Agency.

APPENDIX 1

HABITAT ASSESSMENT AT SAMPLING SITES

Site Code	SW4
Site Location	End of lane, Ballydonagh, c. 2km upstream of landfill
Grid Reference	R9143 4087
Width	1.5m
Depth	8cm
Substrate	Mud, Sand, Gravel
Flow Type	Glide 20% Riffle 80%
Instream Vegetation	Slime 15%
Dominant Bankside Vegetation	Bramble, Hawthorn, Ash
Summer Cover of Stream by Bankside Vegetation	80%
Salmonid Adult Habitat	None
Salmonid Nursery Habitat	Fair-Poor
Salmonid Spawning Habitat	None-Poor

Site Code	SW 1
Site Location	Just upstream of landfill
Grid Reference	R9075 4250
Width	3m
Depth	125cm
Substrate	Mud
Flow Type	Slow Glide 100%
Instream Vegetation	*Phalaris arundinacea* 40% *Callitriche sp.* 10% *Sparganium erectum* 15%
Dominant Bankside Vegetation	Hawthorn
Summer Cover of Stream by Bankside Vegetation	25%
Salmonid Adult Habitat	None
Salmonid Nursery Habitat	None
Salmonid Spawning Habitat	None

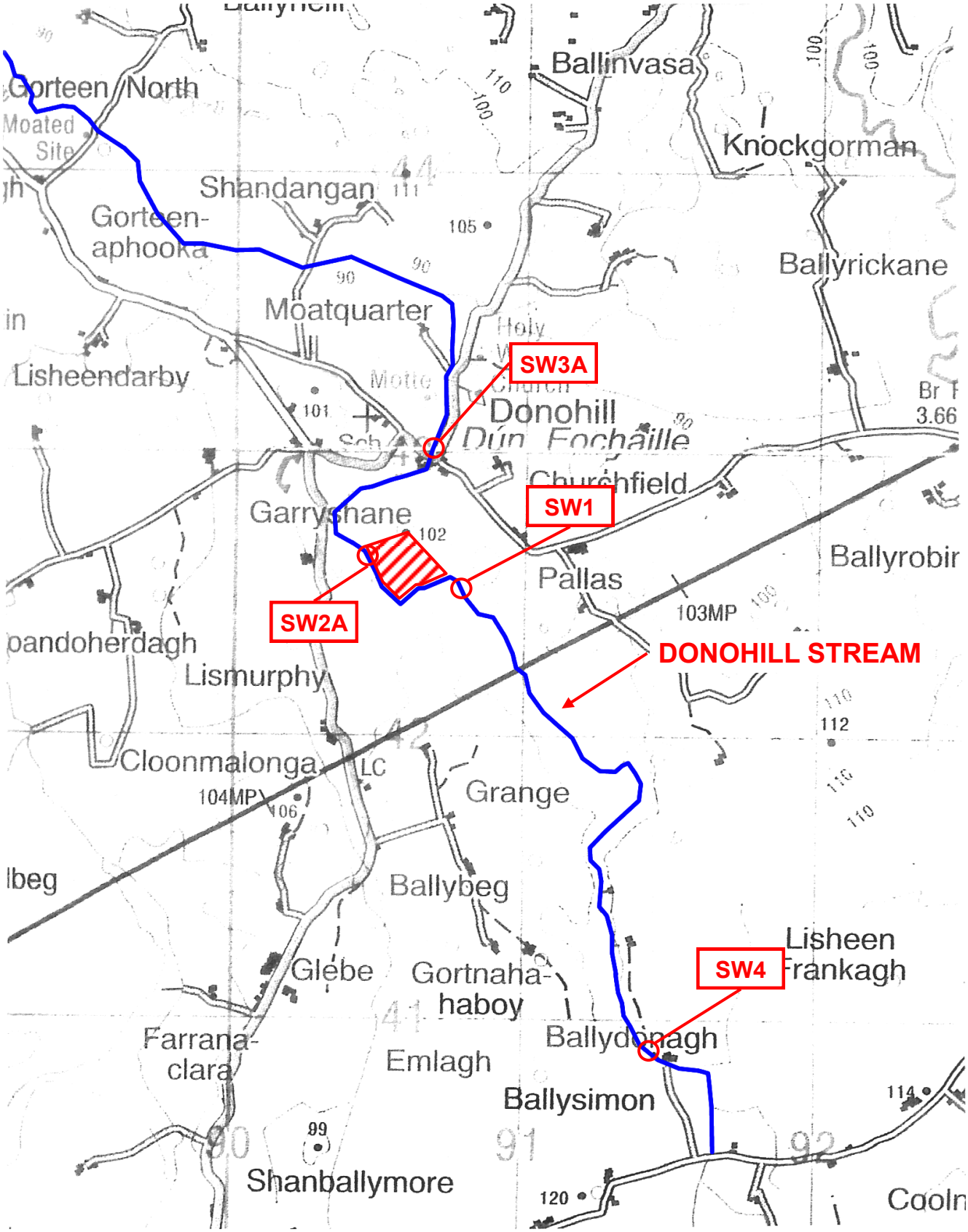
Site Code	SW 2A
Site Location	Just upstream of landfill entrance.
Grid Reference	R 9046 4263
Width	5m
Depth	40cm
Substrate	Mud, Cobble
Flow Type	Glide 100%
Instream Vegetation	*Apium nodiflorum* 70% *Lemna minor* 30% *Rorippa nasturtium-aquaticum* agg. 20% *Callitriche* sp. <5% *Phalaris arundinacea* <5%
Dominant Bankside Vegetation	Nettle, Grass
Summer Cover of Stream by Bankside Vegetation	<5%
Salmonid Adult Habitat	None
Salmonid Nursery Habitat	None
Salmonid Spawning Habitat	None

Site Code	SW 3A
Site Location	Donohill Village d/s bridge
Grid Reference	R 9070 4290
Width	1.5 - 2m
Depth	10 - 15cm
Substrate	Sand, Gravel, Cobble, Mud
Flow Type	Riffle 10% Glide 90%
Instream Vegetation	*Apium nodiflorum* 10% *Phalaris arundinacea* 10%
Dominant Bankside Vegetation	Grasses, Nettle, Bramble
Summer Cover of Stream by Bankside Vegetation	20%
Salmonid Adult Habitat	Poor
Salmonid Nursery Habitat	Fair
Salmonid Spawning Habitat	None-Poor

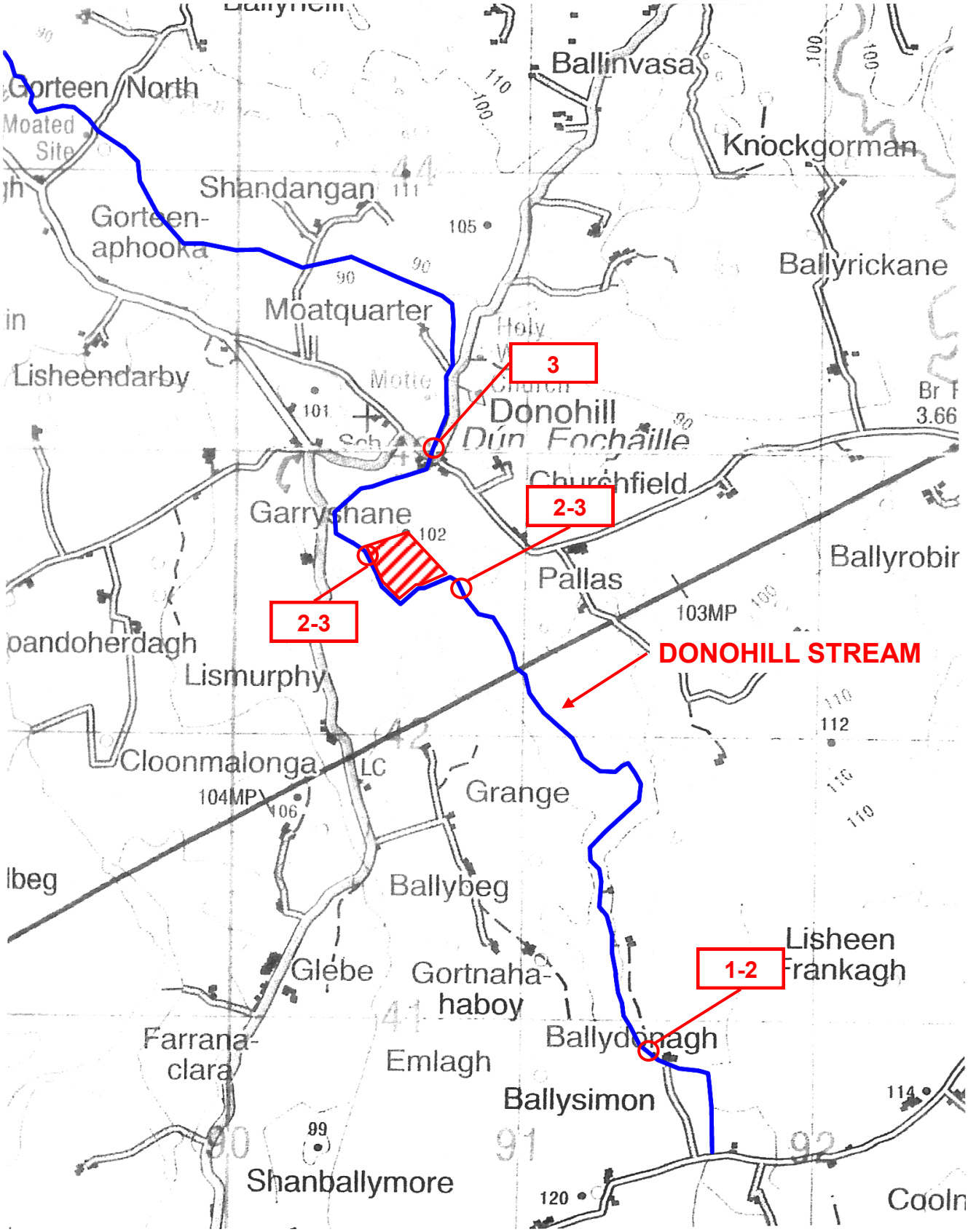
APPENDIX 2

PHOTOGRAPHS

MAP 1 LOCATION OF BIOLOGICAL ASSESSMENT SITES



MAP 2 Q-RATINGS AT BIOLOGICAL ASSESSMENT SITES



APPENDIX 5 GROUNDWATER MONITORING RESULTS

Location	Date Sampled	Water Temp	Depth to GW
GW 11D	29/01/2009	9.9	2.52
GW 11D	27/02/2009	9.5	2.68
GW 11D	30/03/2009	10.2	2.87
GW 11D	29/04/2009	10.8	2.84
GW 11D	29/05/2009	16.2	3.01
GW 11D	30/06/2009	18.6	3.23
GW 11D	09/07/2009	18.9	3.12
GW 11D	31/08/2009	14.3	3.31
GW 11D	29/09/2009	13.8	3.42
GW 11D	29/10/2009	13.5	3.37
GW 11D	30/11/2009	11.1	2.41
GW 11D	21/12/2009	5.1	2.8
Location	Date Sampled	Water Temp	Depth to GW
GW 11S	29/01/2009	10.1	2.93
GW 11S	27/02/2009	10.4	3.05
GW 11S	30/03/2009	10.7	3.18
GW 11S	29/04/2009	11.1	2.11
GW 11S	29/05/2009	16.4	2.48
GW 11S	30/06/2009	18.9	3.3
GW 11S	09/07/2009	19	3.23
GW 11S	31/08/2009	14.1	3.24
GW 11S	29/09/2009	13.7	3.33
GW 11S	29/10/2009	13.2	3.26
GW 11S	30/11/2009	11	2.32
GW 11S	21/12/2009	4.8	2.61
Location	Date Sampled	Water Temp	Depth to GW
GW 12D	29/01/2009	10	9.2
GW 12D	27/02/2009	10.4	9.09
GW 12D	30/03/2009	10.6	9.21
GW 12D	29/04/2009	11	9.17
GW 12D	29/05/2009	16.6	9.58
GW 12D	30/06/2009	19.1	9.51
GW 12D	09/07/2009	19.1	9.62
GW 12D	31/08/2009	19.6	9.92
GW 12D	29/09/2009	16.4	10.08
GW 12D	29/10/2009	16.1	9.9
GW 12D	30/11/2009	10.9	8.25
GW 12D	21/12/2009	5.9	8.73
Location	Date Sampled	Water Temp	Depth to GW
GW 12S	29/01/2009	9.9	9.1
GW 12S	27/02/2009	10.7	8.96
GW 12S	30/03/2009	10.9	9.04
GW 12S	29/04/2009	11.3	8.94
GW 12S	29/05/2009	16.8	9.22
GW 12S	30/06/2009	19.3	9.76
GW 12S	09/07/2009	19.2	9.81
GW 12S	31/08/2009	19.7	9.71
GW 12S	29/09/2009	16.4	9.83
GW 12S	29/10/2009	15.9	9.72
GW 12S	30/11/2009	10.7	8.4
GW 12S	21/12/2009	5.8	8.55

Location	Date Sampled	Water Temp	Depth to GW
GW 13	29/01/2009	10.2	2.01
GW 13	27/02/2009	10	2.39
GW 13	30/03/2009	10.2	2.19
GW 13	29/04/2009	10.8	2.06
GW 13	29/05/2009	16.3	2.35
GW 13	30/06/2009	18.4	2.76
GW 13	09/07/2009	18.7	2.85
GW 13	31/08/2009	19.5	2.94
GW 13	29/09/2009	16.2	3.05
GW 13	29/10/2009	15.7	2.92
GW 13	30/11/2009	11.2	2.12
GW 13	21/12/2009	8.9	2.2
Location	Date Sampled	Water Temp	Depth to GW
GW 14	29/01/2009	10.3	6.54
GW 14	27/02/2009	10.8	6.87
GW 14	30/03/2009	10.9	6.8
GW 14	29/04/2009	11.3	6.72
GW 14	29/05/2009	16.8	6.98
GW 14	30/06/2009	19	7.28
GW 14	09/07/2009	18.9	7.36
GW 14	31/08/2009	14.7	7.44
GW 14	29/09/2009	13.5	7.54
GW 14	29/10/2009	12.8	7.45
GW 14	30/11/2009	10.8	6.5
GW 14	21/12/2009	4.6	6.72
Location	Date Sampled	Water Temp	Depth to GW
GW 15	29/01/2009	10.2	5.33
GW 15	27/02/2009	12.3	5.62
GW 15	30/03/2009	11.9	5.54
GW 15	29/04/2009	12.4	5.49
GW 15	29/05/2009	17.2	6.12
GW 15	30/06/2009	19.5	6.11
GW 15	09/07/2009	19.4	6.2
GW 15	31/08/2009	15	6.31
GW 15	29/09/2009	14.1	6.42
GW 15	29/10/2009	13.2	6.37
GW 15	30/11/2009	11.3	5.92
GW 15	21/12/2009	4.2	6.05

2009 Groundwater Monitoring

GW11d

LOCATION_	unit					
CODE			WST-W0074-02-GW11d	WST-W0074-02-GW11d	WST-W0074-02-GW11d	Median
Depth of Borehole	m		40	40	40	
Temperature	°C		12.2	11.3	10.2	11.3
pH	pH		7.5	7.6	7.6	7.6
Conductivity @25°C	uS/cm		666	643	695	666
Ammonia	mg/l N		0.069	0.27	0.08	0.08
Chloride	mg/l Cl		17	16	18	17
Total coliforms	No/100 ml		10	**24000**	**1000**	1000
EColi	per 100ml		10	**200**	10	10
DO			42	**93**	57	57
Iron			250	**580**	340	340
TOC				**0.5**	0.5	0.5
TON			0.6	**5.4**	2.3	2.3

GW12s

LOCATION_	unit					
CODE		WST-W0074-02-GW12s	WST-W0074-02-GW12s	WST-W0074-02-GW12s		Median
Depth of Borehole	m	14.6	14.5	14.5		14.5
Temperature	°C	10.7	11	10.8		10.8
pH	pH	7.4	7.3	7.2		7.3
Conductivity @25°C	uS/cm	783	785	790		785
Ammonia	mg/l N	0.013	0.017	0.02		0.017
Chloride	mg/l Cl	20	21	21		21
Total coliforms	No/100 ml	<10	**230**	10		120
EColi	per 100ml	10	10	10		10
DO		80	68	77		77
Iron		200	160	86		160
TOC		0.5		0.5		0.5
TON		7.1	4.9	4.7		4.9

GW12d

LOCATION_CODE	unit	WST-W0074-02-GW12d	WST-W0074-02-GW12d			Median
Depth of Borehole	m	32.1	32.1			32.1
Temperature	°C	10.9	11.4			11.15
pH	pH	7.3	7.3			7.3
Conductivity @25°C	uS/cm	811	814			812.5
Ammonia	mg/l N	0.008	0.014			0.011
Chloride	mg/l Cl	24	23			23.5
Total conforms	No/100 ml	10	**24192**			12101
EColi	per 100ml	10	10			10
DO		25	20			22.5
Iron		200	250			225
TOC		0.5				0.5
TON		2.4	0.8			1.6

GW13

LOCATION_CODE	unit	WST-W0074-02-GW13	WST-W0074-02-GW13	WST-W0074-02-GW13	WST-W0074-02-GW13	Median
Depth of Borehole	m	14	31	14	14	14
Temperature	°C	10.7	11.2	11.2	10.4	10.95
pH	pH	7.7	7.6	7.3	7.4	7.5
Conductivity @25°C	uS/cm	577	575	577	655	577
Ammonia	mg/l N	0.096	0.1	0.09	0.05	0.093
Chloride	mg/l Cl	15	16	14	15	15
Total conforms	No/100 ml	10	10	10	5	10
EColi	per 100ml	10	10	10	5	10
DO		35	27	25	26	26.5
Iron		200	250	94	390	225
TOC		0.5		0.5	0.5	0.5
TON		1.1	0.1	0.5	0.6	0.55

GW14 LOCATION_CODE	unit	WST-W0074-02-GW14	WST-W0074-02-GW14	WST-W0074-02-GW14	WST-W0074-02-GW14	Median
Depth of Borehole	m	35	31.4	35	35	35
Temperature	°C	11.4	12	11.8	10.6	11.6
pH	pH	7.6	7.5	7.4	7.6	7.55
Conductivity @25°C	uS/cm	551	593	607	676	600
Ammonia	mg/l N	0.043	0.01	<0.01	0.06	0.043
Chloride	mg/l Cl	20	16	17	22	18.5
Total conforms	No/100 ml	10	63	31	10	20.5
EColi	per 100ml	10	10	10	10	10
DO		73	42	51	60	55.5
Iron		160	480	110	920	320
TOC		0.5		0.5	0.5	0.5
TON		2.3	0.3	0.5	2.7	1.4

GW15

LOCATION_CODE	unit	WST-W0074-02-GW15	WST-W0074-02-GW15	WST-W0074-02-GW15	WST-W0074-02-GW15	Median
Depth of Borehole	m	33	33.4	33.4	33.4	33.4
Temperature	°C	11	11.7	11.2	10.8	11.1
pH	pH	7.5	7.3	7.4	7.5	7.45
Conductivity @25°C	uS/cm	663	673	666	590	664.5
Ammonia	mg/l N	0.057	0.14	0.05	0.06	0.0585
Chloride	mg/l Cl	19	20	19	18	19
Total conforms	No/100 ml	10	10	10	5	10
EColi	per 100ml	10	10	10	5	10
DO		41	29	29	37	33
Iron		110	150	120	90	115
TOC		0.5		0.5	0.5	0.5
TON		0.2	0.1	0.5	1	0.35

GW16

LOCATION_CODE	unit	WST-W0074-02-GW16	WST-W0074-02-GW16	WST-W0074-02-GW16	WST-W0074-02-GW16	Median
Depth of Borehole	m	nm	-	Shallow open well	Shallow open well	
Temperature	°C	8.4	12.2	12.4	10.5	11.35
pH	pH	6.9	7.5	7.1	6.9	7
Conductivity @25°C	uS/cm	821	100	829	707	764
Ammonia	mg/l N	0.005	0.13	2	0.03	0.08
Chloride	mg/l Cl	15	16	12	9	13.5
Total conforms	No/100 ml	10	**9800**	**2000**	5	1005
EColi	per 100ml	10	**20**	**20**	5	15
DO		40	53	53	50	51.5
Iron		98	250	25	91	94.5
TOC		1.2		2.3	0.5	1.2
TON		5	5.3	2.2	4.6	4.8

APPENDIX 6 WATER BALANCE CALCULATIONS

JOB NO:	**LW10-024-01**				
TITLE:	**Water Balance for Donohill Landfill for 2009 AER Report**			**Checked By:**	AR
CALCULATIONS BY:	DD			**Approved by:**	BG
DATE:	5-Feb-10	**REV:**	0		

2 Design Criteria

	Zone	Area (m^2)	Infiltration (%)	Description
1	Zone 1 :	20,645	5%	- Phase 1 engineered cap; Area 2 Cell is included in this zone (6,355 m2); cap draining to storm pond SW5 & SW7
2	Zone 2 :	2,310	5% / 100%	- In 2007 a second swale was installed to reduce the volume of surface water being collected as leachate. There is approx 1155 m2 draining to SW8 & approx 1155 m2 draining to LE8.
3	Zone 3 :	4,220	100%	- Uncapped area; this zone is filled to max levels
4	Zone 4a :	1,620	100%	- 'No Access' area; cannot fill here until Area 4 is filled
	Zone 4b :	1,215	100%	- 'No Access' area; cannot fill here until Area 4 is filled
5	Zone 5a :	1,020	65%	- Area 3 Cell; approx. 750mm temporary cap area installed
	Zone 5b :	2,005	100%	- Area 3 Cell; relocated haul road comprising a layer of pozidrain and approx. 750mm temporary cap installed however runoff flows inito site so approx infiltration rate used
6	Zone 6 :	5,480	100%	- Current active area with void space remaining; extends somewhat into Area 3 Cell; contains two areas that are temporarily capped - 577 m2 & 1272 m2
7	Zone 7 & 8 :	4,665	100%	- Area 4: Active area

8

Month	Rainfall 2009
January	123.6
February	14.2
March	45.2
April	72.2
May	80.2
June	71.4
July	128.7
August	95.6
September	39.4
October	123.2
November	229.4
December	50.6
Total	**1073.7**

Actual Site Recorded Data

JOB NO: LW10-024-01
TITLE: Water Balance for Donohill Landfill for 2009 AER Report
CALCULATIONS BY: DD
DATE: 05/02/2010

Rev: 0
Checked By: AR
Approved by: BG

Water Balance Calculation for Donohill Landfill Facility

Month	Rainfall	Evaporation	Effective Rainfall	Waste Input	Active Area (Z3, Z4, Z5b Z6, Z7, Z8)	Intermediate Area (temporarily capped) Z5a	Fully Capped Area (Z1)	Partly capped area with runoff to leachate trench (Z2)	Active Infiltration	Infiltration from runoff to leachate trench	Intermediate Infiltration *	Capped Infiltration	Liquid Waste	Lagoon Contribution	Absorptive Capacity	Active Leachate	Contaminated water from Cell 4 settlement	Total Leachate Production	Cumulative Leachate Production
	(mm)	(mm)	(mm)	(tonnes)	(m^2)	(m^2)	(m^2)	(m^2)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)
Jan-09	123.6	12.36	111.24	1,687	19,205	1,020	20,645	2,310	2,373.7	134.9	73.8	114.8	*0*	63.4	118.1	2255.6	500	3,142.5	3,142.5
Feb-09	14.2	1.42	12.78	1,616	19,205	1,020	20,645	2,310	272.7	15.5	8.5	13.2	*0*	7.3	113.1	159.6	500	704.1	3,846.6
Mar-09	45.2	4.52	40.68	1,418	19,205	1,020	20,645	2,310	868.1	49.3	27.0	42.0	*0*	23.2	99.3	768.8	500	1,410.3	5,256.9
Apr-09	72.2	7.22	64.98	2,207	19,205	1,020	20,645	2,310	1,386.6	78.8	43.1	67.1	*0*	37.0	154.5	1232.1	500	1,958.1	7,215.0
May-09	80.2	8.02	72.18	1,417	19,205	1,020	20,645	2,310	1,540.2	87.5	47.9	74.5	*0*	41.1	99.2	1441.1	500	2,192.1	9,407.1
Jun-09	71.4	7.14	64.26	1,001	13,725	6,500	20,645	2,310	980.0	77.9	271.5	66.3	*0*	36.6	70.0	909.9	500	1,862.3	11,269.4
Jul-09	128.7	12.87	115.83	1,272	13,725	6,500	20,645	2,310	1,766.4	140.5	489.4	119.6	*0*	66.0	89.0	1677.4	500	2,992.8	14,262.2
Aug-09	95.6	9.56	86.04	912	13,725	6,500	20,645	2,310	1,312.1	104.3	363.5	88.8	*0*	49.0	63.8	1248.3	500	2,354.0	16,616.2
Sep-09	39.4	3.94	35.46	1,562	13,725	6,500	20,645	2,310	540.8	43.0	149.8	36.6	*0*	20.2	109.3	431.5	500	1,181.1	17,797.3
Oct-09	123.2	12.32	110.88	1,031	13,725	6,500	20,645	2,310	1,690.9	134.5	468.5	114.5	*0*	63.2	72.2	1618.8	500	2,899.4	20,696.7
Nov-09	229.4	22.94	206.46	1,506	13,725	6,500	20,645	2,310	3,148.5	250.4	872.3	213.1	*0*	117.7	105.4	3043.1	500	4,996.6	25,693.3
Dec-09	50.6	5.06	45.54	1,306	13,725	6,500	20,645	2,310	694.5	55.2	192.4	47.0	*0*	26.0	91.4	603.1	500	1,423.7	27,117.0
Total	**1,074**	**107**	**966**	**16,933**					**16,575**	**1,172**	**3,008**	**997**	**0**	**551**	**0**	**15,389**	**6,000**	**27,117**	

Notes:
The calculation was carried out using MS Excel following the method from the EPA Landfill Manual on Landfill Site Design, as shown:

Lo = [ER(A) + LW + IRCA + ER(l)] - a(W);

where:	Lo =	leachate produced(m3)
	ER =	effective rainfall, actual rainfall (R) is used for active cells (m) [(ER) is defined as Total Rainfall (R) minus Actual Evapotranspiration (AE) i.e. ER=R-AE]
	A =	area of cell (m2)
	LW =	liquid waste (m3)
	IRCA =	infiltration through restored and capped areas (m3)
	l =	surface area of lagoons (m2)
	a =	absorptive capacity of waste (m3/t)
	W =	weight of waste deposited (t/a)

* Infiltration Rates (%) Look to Design Criteria for exact figures (Ranges from 5% to 100%)

** Temporary Cap on Z6 in May 2009
0.07

† Absorptive Capacity (m3/tonne)

APPENDIX 7 NOISE MONITORING REPORT

South Tipperary County Council

Donohill Landfill Site

Garryshane, Donohill, Co. Tipperary

Annual Environmental Noise Survey

Report Date:

16th November 2009

EURO environmental services

Unit 35A, Boyne Business Park, Drogheda, Co Louth

Report No. 4190/M07

1.0 Introduction

EURO environmental services was commissioned by Louise Ryan of South Tipperary County Council to conduct an environmental noise survey at the Donohill Landfill Site, Garryshane, Donohill, Co. Tipperary. The noise survey was carried out on six pre-determined perimeter-monitoring points on the 30th October 2009 by Victor Olmos of EURO environmental services as per requirement of Schedule D.4 of Waste Licence No. 74-2.

2.0 Duration and Measurements of Surveying

The survey was carried out between 10:24 and 13:53 on Friday the 30th of October 2009. The following measurements were carried out at each monitoring point:

- Daytime Broadband measurements $L(A)_{eq}$, $L(A)_{10}$, $L(A)_{90}$, $L(A)_{50}$, $L(A)_{1}$ and $L(A)_{99}$ over a 30 minute period.
- Daytime 1/3 Octave Band measurements over a 30 minute period in the range 25Hz to 16kHz.

3.0 Weather Conditions

Weather conditions were raining and overcast with a slight breeze blowing at <5m/sec. Temperatures ranged between 10–12 ^{0}C during the monitoring.

4.0 Location of Monitoring Points

N1 was located on hard ground along the northern site boundary. The meter was placed approximately 1m from the boundary fence.

N2 was located on hard ground at the quarantine area of the site. The meter was placed approximately 45-50m away from the waste tipping area on the active waste cell.

N3 is located on hard ground on the capped area of the landfill site, near the southern site boundary.

N4 was located on hard ground, approximately 35-40m away from the weighbridge office area. The monitoring location was also located approximately 50-60m from the landfill gas flare.

S1 was a noise sensitive location, located at a house on the R497 Road, across from the site entrance. The meter was placed on hard ground approximately 2.5m away from the road and 30 metres away from landfill access gate.

S2 was a noise sensitive location at a dwelling house located approximately 120-150m to the north of the landfill site. The meter was placed on hard ground, approximately 2m from the edge of a roadway where the dwelling was located.

5.0 Activities on Site

Activities on site continued as normal during the daytime survey. Vehicles entered and left the site and waste disposal operations within the site continued.

6.0 Methodology

The noise survey was carried out in accordance with ISO 1996/1/2/3 – Acoustics – Description and Measurement of Environmental Noise and The Environmental Noise Survey Guidance Document issued by the EPA.

Reference was also made to the guidance note issued by the Environmental Protection Agency for the assessment of noise from licensed facilities.

7.0 Equipment

The equipment used was a Bruel & Kjaer 2250 serial No. 2463166 integrating sound pressure meter, with selective 1:1 or 1:3 octave band measurements.

The meter was fixed to a tripod 1.3 meters above ground level and the microphone was protected using a windshield. The microphone cartridge type was BK4189, serial number 2457949 with open circuit sensitivity level of 53.2 mV per Pa.

8.0 Calibration

Calibration was carried out on site using an acoustic calibrator at 94dBA. The meter was calibrated before and after the monitoring round.

9.0 Day Time Measurements

Monitoring Point	Date/ Time	Sampling Interval minutes	L(A)eq	$L(A)_{10}$	$L(A)_{90}$	Comments
N1	30/10/2009 12:17	30	53	54	36	Main source of noise was produced by plant idling, waste lorry driving on site, reverse beeping siren and an excavator and compactor truck in operation at active cell. Interference noises included traffic movements on R497 road, wind blowing, birds singing and trains passing.
N2	30/10/2009 12:51	30	55	54	39	Main source of noise was generated by waste lorries idling, plant in operation in the distance, cars idling at recycling area, people talking, waste bags being dropped and cars leaving recycling area. Interference noise included rainfall, wind blowing, train and horn of train sounding, plane flying overhead and traffic movements on the R497 road.
N3	30/10/2009 11:40	30	53	53	38	Some low level noise audible from landfill site. Main source of noise was produced by traffic movements around site, workers talking and plant idling on site. Interference noise included traffic movements on the R497 road, breeze blowing, birds singing, dog barking, train and the horn of train sounding.
N4	30/10/2009 13:23	30	50	49	40	Main sources of noise were generated by lorries and cars driving to and from site and idling at weigh bridge (3 cars and 2 HGV). Interference noise included traffic movements on the R497 road, rain falling on the ground and train passsing.
S1	30/10/2009 10:58	30	67	65	45	Main source of noise was produced by vehicles driving into and out of landfill site and lorries idling on site. Interference noise included traffic movements on the R497 road (43 cars and 2 HGV)
S2	30/10/2009 10:24	30	61	64	46	No noise audible from landfill. Interference noise included rain falling on the ground and traffic movements on the R497 road (3 cars).

10.0 Third Octave Noise Measurements

Third octave noise monitoring results are attached in the appendix and are used to identify prominent tonal components in noise. Tonal noise components were detected at monitoring location S2 at frequency of 63Hz (55.8 dB) and at monitoring location N4 at frequency of 16Hz (64.2 dB). These tonal noise components may be attributable to vehicles idling in close vicinity to these monitoring locations.

11.0 Interference

Traffic had an influence on the monitoring locations N1, N3, N4, S1 and S2 as these monitoring locations were located close to roads. Trains and train horns were also audible at locations N1, N2, N3 and N4.

12.0 Summary and Conclusions

Noise levels were determined at six monitoring points around the Donohill Landfill site. The EPA recommend a day time noise limit of 55 dB(A).

Two out of the six monitoring points exceeded the recommended day time noise limit of 55 dB(A) although main sources of noise recorded at them were not produced by landfill activities but interferences such as rainfall and traffic movements in the vicinity of these monitoring locations.

Tonal noise components were detected at two of the six noise monitoring locations (S2 and N4). The source of the tonal components may be attributable to vehicles idling in close vicinity to these monitoring locations.

Aadil Khan
Environmental Technical Manager

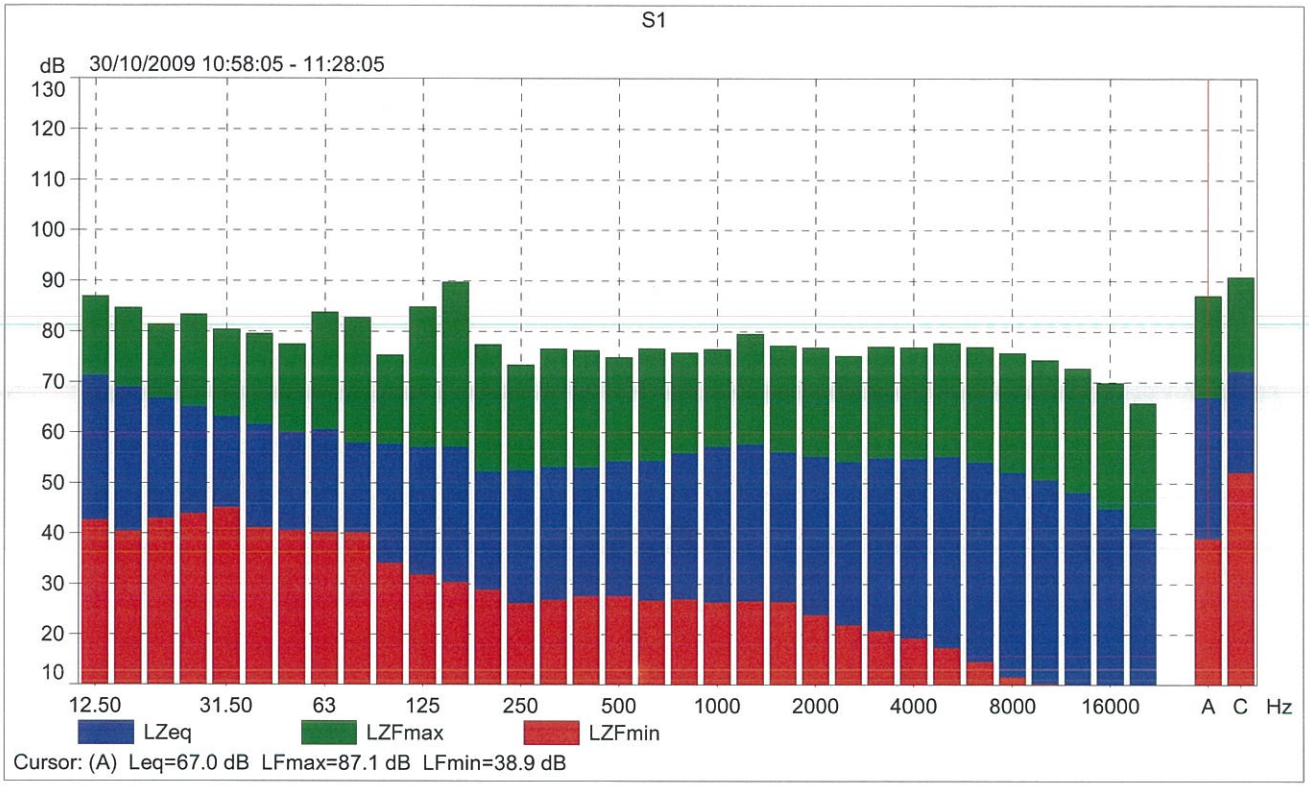
Victor Olmos
Environmental Technician

16th November 2009

Appendix 1: Broadband and 1/3 Octave Monitoring Data

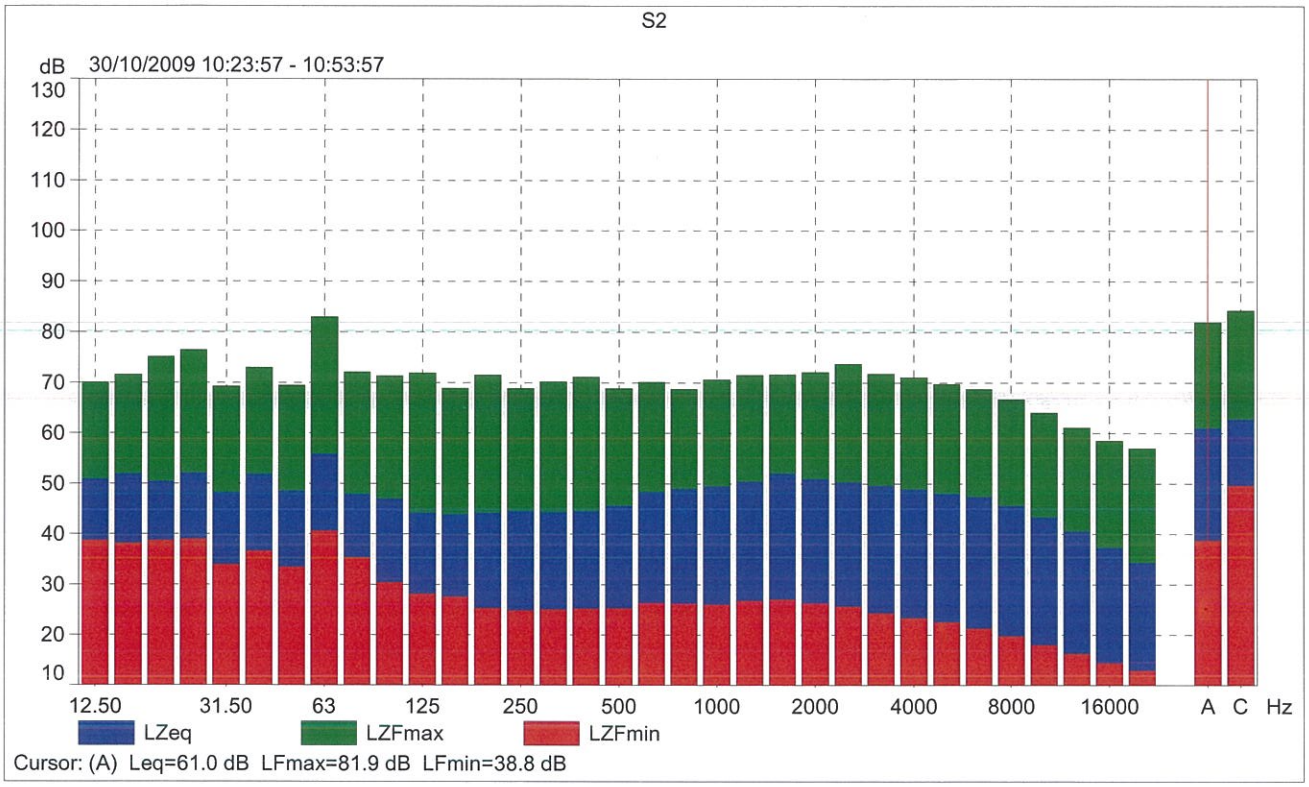
S1

	Start time	End time	Overload [%]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LAF10 [dB]	LAF90 [dB]	LCpeak [dB]
Value			0.00	87.1	38.9	67.0	64.9	45.4	104.4
Time	10:58:05	11:28:05							10:58:11
Date	30/10/2009	30/10/2009							30/10/2009



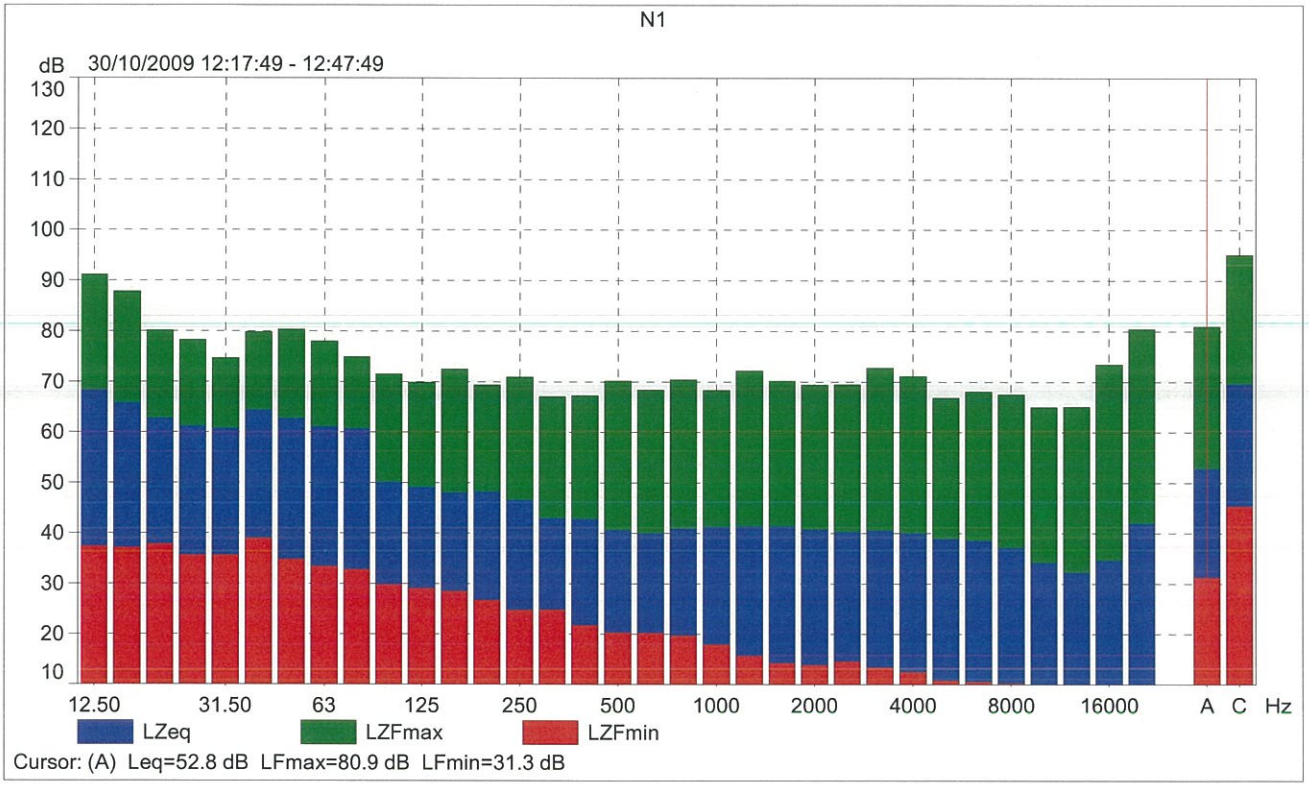
S2

	Start time	End time	Overload [%]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LAF10 [dB]	LAF90 [dB]	LCpeak [dB]
Value			0.00	81.9	38.8	61.0	64.4	45.7	98.7
Time	10:23:57	10:53:57							10:24:17
Date	30/10/2009	30/10/2009							30/10/2009



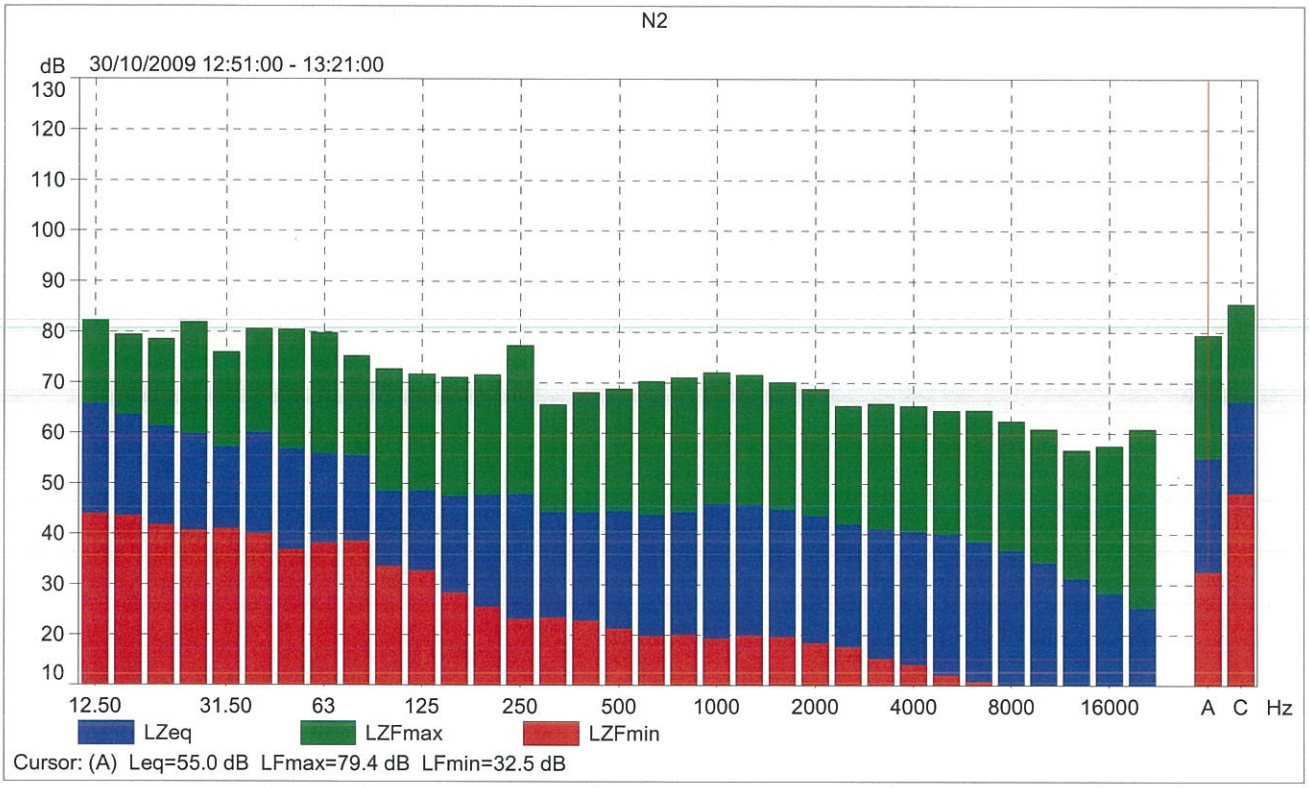
N1

	Start time	End time	Overload [%]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LAF10 [dB]	LAF90 [dB]	LCpeak [dB]
Value			0.00	80.9	31.3	52.8	54.0	36.3	104.2
Time	12:17:49	12:47:49							12:25:14
Date	30/10/2009	30/10/2009							30/10/2009



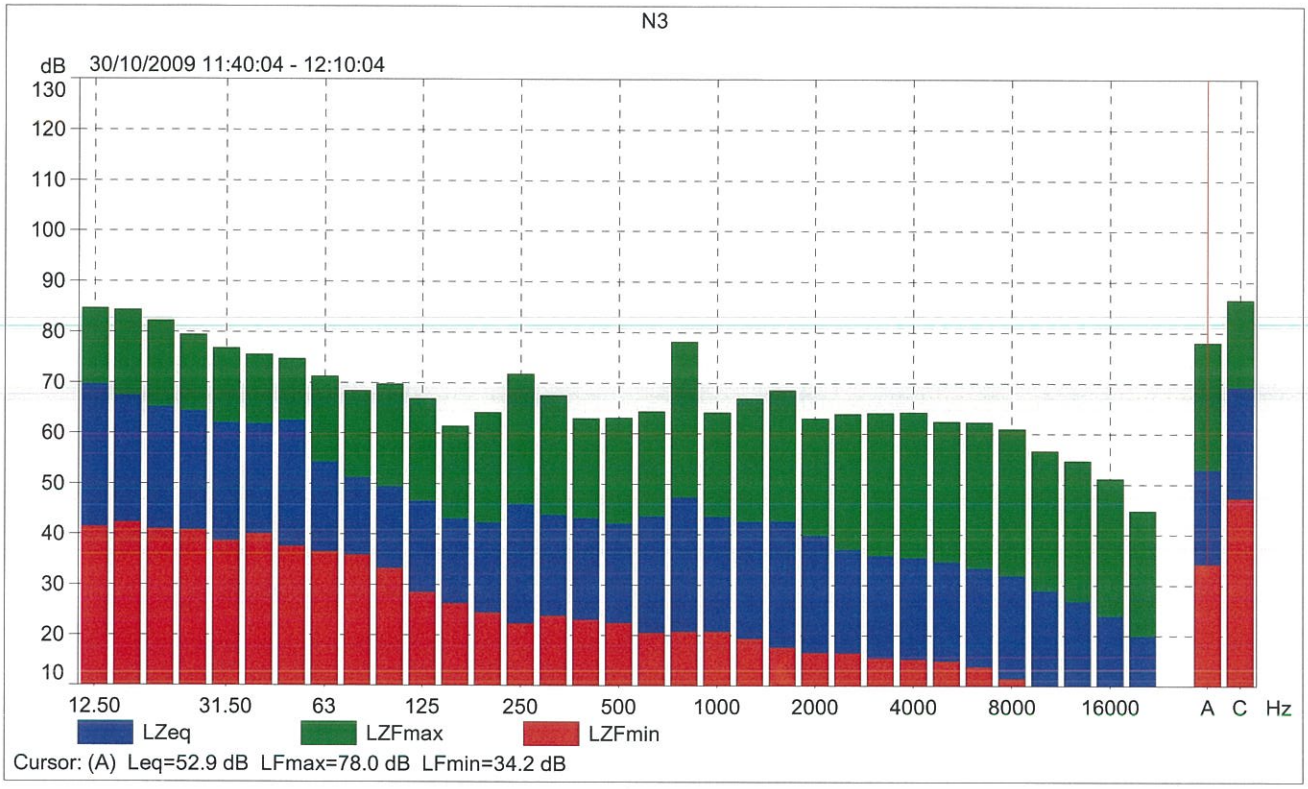
N2

	Start time	End time	Overload [%]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LAF10 [dB]	LAF90 [dB]	LCpeak [dB]
Value			0.00	79.4	32.5	55.0	54.3	38.9	104.2
Time	12:51:00	13:21:00							13:02:08
Date	30/10/2009	30/10/2009							30/10/2009



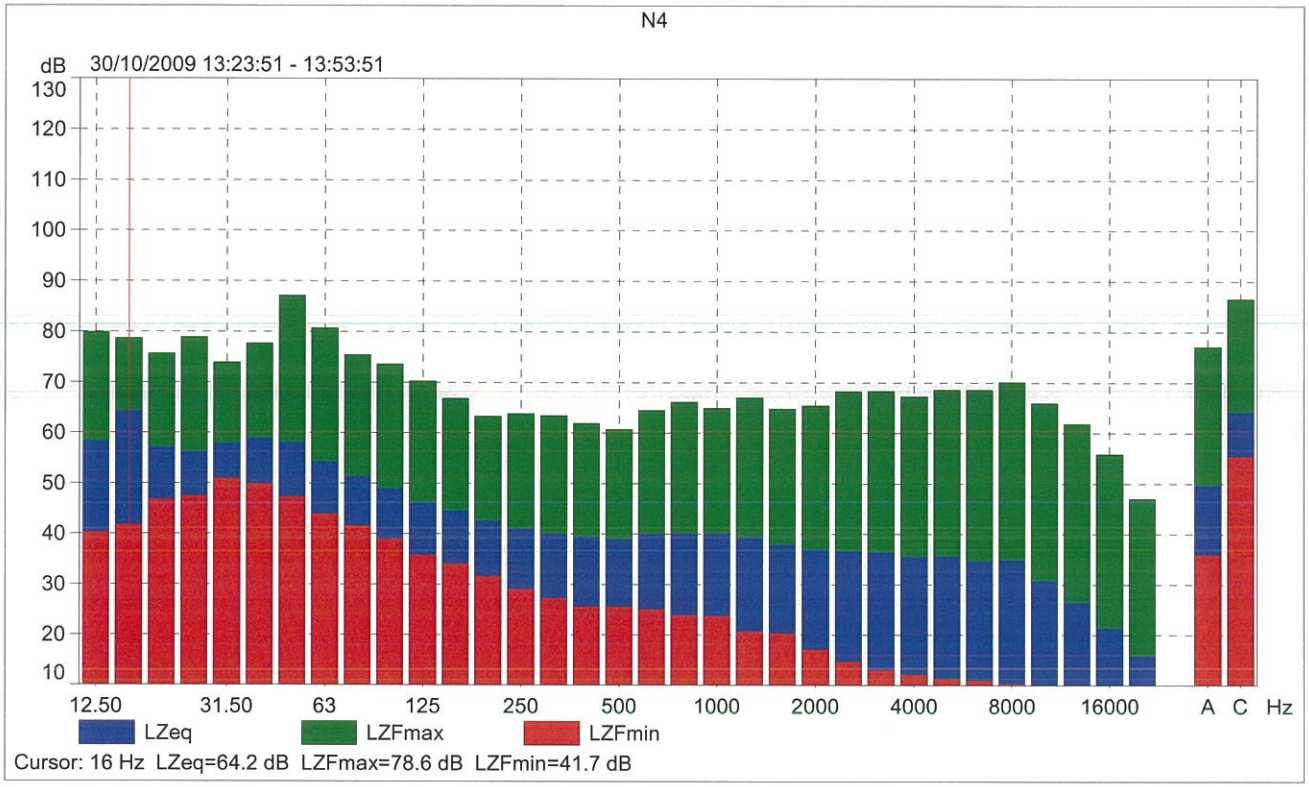
N3

	Start time	End time	Overload [%]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LAF10 [dB]	LAF90 [dB]	LCpeak [dB]
Value			0.00	78.0	34.2	52.9	52.9	38.4	94.0
Time	11:40:04	12:10:04							12:03:07
Date	30/10/2009	30/10/2009							30/10/2009



N4

	Start time	End time	Overload [%]	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LAF10 [dB]	LAF90 [dB]	LCpeak [dB]
Value			0.00	77.0	35.8	49.7	49.4	39.7	100.2
Time	13:23:51	13:53:51							13:23:52
Date	30/10/2009	30/10/2009							30/10/2009



APPENDIX 8 LANDFILL GAS CALCULATIONS

ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

DONOHILL LANDFILL

LANDFILL GAS REPORT 2009

WASTE LICENCE REGISTER W0074-02

FEBRUARY 2010

FEHILY TIMONEY & COMPANY

DONOHILL LANDFILL

LANDFILL GAS REPORT 2009

WASTE LICENCE REGISTER W0074-02

User is Responsible for Checking The Revision Status of This Document

Rev. Nr.	Description of Changes:	Prepared by:	Checked by:	Approved by:	Date:
A	Draft	DD	AR		15/02/2010
0	Issue to Client	DD	AR		18/02/2010

Client South Tipperary County Council

Keywords landfill gas model, estimated emissions, Donohill, landfill, landfill gas, active extraction system, methane, carbon dioxide, AER

Abstract FTC was retained by South Tipperary County Council to prepare this section of the annual environmental report – the estimation of annual and cumulative quantities of landfill gas emitted from Donohill landfill facility. This is traditionally carried out using a landfill gas prediction model. The results of these models have been found by FTC to be quite inaccurate and so we have combined factual data from site, flaring volumes etc with information from the model to estimate the quantity of landfill gas that was emitted to atmosphere in 2009 and the cumulative quantity since landfilling began.

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1 INTRODUCTION

1.1 Purpose

This calculation is a requirement of the Annual Environmental Report (AER). Calculations have been carried out to estimate the quantity of landfill gas emitted from the facility in 2008 and the cumulative quantity emitted since landfilling operations commenced in 1989.

Donohill Landfill is owned and operated by South Tipperary County Council (STCC). The landfill has an active landfill gas (LFG) extraction system and a 500 m^3/hour enclosed flare. The site is licensed by the Environmental Protection Agency (EPA), waste licence register number W0074-02. The production of an AER is a requirement of the waste licence (Schedule G).

1.2 Background Information

The landfill has been operational since 1989. There was an open flare on site from January to April 2005. It was replaced in May 2005 with a 500 m^3 enclosed flare. The first phase of engineered capping was completed in May 2006. Areas 1 and 2 are capped now. Filling is taking place in Area 4.

Landfill gas generation can only be estimated. There are 2 no. estimator tools; LandGem and Gassim. LandGem was produced by the US EPA and has been approved by the Irish EPA. Gassim was developed more recently by the UK EA. FTC has used both models and finds them both to have inaccuracies. LandGem is more user friendly and has been used in these calculations.

2 QUANTITIES OF LANDFILL GAS EMITTED

Two sources were used to calculate landfill gas emissions:

1. Landfill Gas Flare data
2. LandGem landfill gas prediction model

2.1 Landfill Gas Flare Data

In 2009 the flare ran for 2,246 hours. The flare ran at approximately 38% of capacity based on data from STCC. Based on this information, it is estimated that 426,227 m^3 of landfill gas was flared in 2009.

2.2 LandGem Gas Prediction Model

The model produces a report which has been included as Appendix 1. LandGem is an estimator tool for landfill gas generation from a landfill. It does not estimate emissions as it does not take flaring or utilisation into account.

A summary table of results has been shown as Table 2.1.

Table 2.1: Summary of LandGem Results

	Landfill Gas	Methane*	Carbon Dioxide*
2009 (annual quantity)			
Volume (m^3)	2,271,000	1,135,000	1,135,000
1989-2009(cumulative quantity)			
Volume (m^3)	20,433,738	10,216,869	10,216,869

* The model assumes that methane (CH_4) and carbon dioxide (CO_2) are present in equal volumes, 50%:50% of the landfill gas.

2.3 Estimate of Landfill Gas Emissions

2.3.1 Annual Emissions (2009)

There is an enclosed flare on site to combust landfill gas to reduce emissions. As shown in Section 2.1, it is estimated that 426,227 m^3 of landfill gas was flared in 2009.

Volume of landfill gas generated in 2009 (LandGem): 2,271,000 m^3
Volume of landfill gas flared in 2009 (site records): 426,227 m^3
Therefore, Volume of landfill gas emitted to atmosphere: 1,844,733 m^3

2.3.2 Cumulative Emissions (1989-2009)

As seen in Table 2.1, 20,433,738 m^3 of landfill gas is estimated to have been generated by the facility since it commenced landfilling operations in 1989. It is difficult to estimate the quantity of that gas that was emitted to atmosphere as the flaring records are poor.

The enclosed flare was commissioned in May 2005. Using data from the 2006, 2007 & 2008 AER and this year's data, the quantity of gas flared can be subtracted from the cumulative generation.

The temporary flare was running for 2,477 hours in 2005. It is estimated that the flare was running at 150m^3 per hour and at approximately 35% methane. For the purposes of this calculation the temporary flare was in operation between January and April in 2005.

An enclosed flare was commissioned in May 2005. The capacity of the flare is 500 m^3 per hour. The average flow rate was 200 m^3 per hour. Methane content was 35%. Flare record show 728 hours of running time between May 2005 and December 2005.

Temporary flare 2005: 4 months: 2,477 hours @ 150 m^3/hour = 371,550 m^3
Enclosed Flare 2005: 8 months: 728 hours @ 200 m^3/hour = 145,600 m^3
Enclosed Flare 2006: 12 months: 2,550 hours @ 285 m^3/hour = 755,820 m^3
Enclosed Flare 2007: 12 months: 4,962 hours @ 200 m^3/hour = 992,400 m^3
Enclosed Flare 2008: 12 months: 3,547 hours @ 210 m^3/hour = 744,870 m^3

Total Cumulative landfill gas generation
1989-2009 =20,433,738 m^3
2009 volume flared =426,227 m^3
2008 volume flared =744,870 m^3
2007 volume flared =992,400 m^3
2006 volume flared =755,820 m^3
2005 volume flared =517,150 m^3

Cumulative emissions to atmosphere 1989-2009 = 16,997,271 m^3

Assumptions made in the calculations:

- Landfill gas generation at Donohill is as per the LandGem model (Methane Generation Rate, k $year^{-1}$ = Inventory Conventional 0.04; Potential Methane Generation Capacity, L_o m^3/Mg = Inventory Conventional 100)
- Methane and carbon dioxide are generated in equal volume as 50%:50% of landfill gas (this is not true at Donohill but the calculations had to be consistent with LandGems assumptions)
- Flare and waste records and are correct

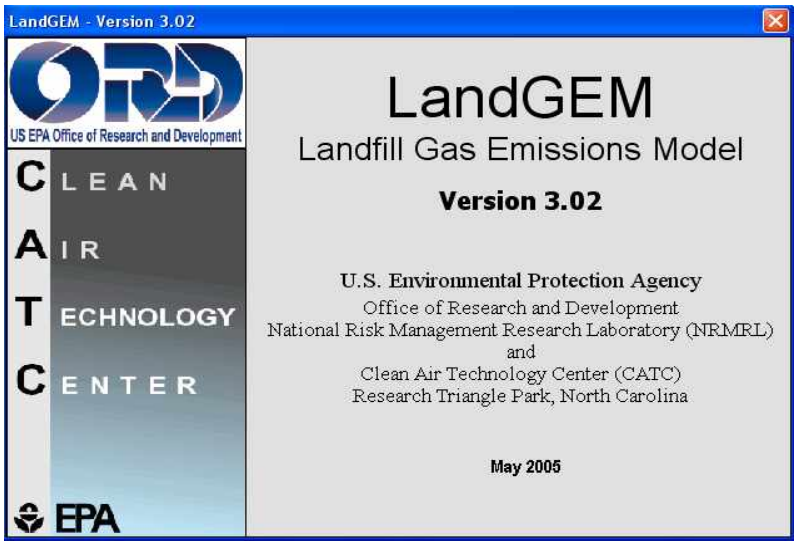
3 CONCLUSION

1,844,733 m^3 of landfill gas is estimated to have been emitted to atmosphere in 2009.

16,997,271 m^3 of landfill gas is estimated to have been emitted to atmosphere since landfilling operations commenced in 1989.

Appendix 1

LandGem Model Report



Summary Report

Landfill Name or Identifier: Donohill Landfill

Date: 18 February 2010

Description/Comments:
This model has been produced for the AER 2009. It's an estimate of landfill gas generated at the site. The model does not input flaring or utlisation quantities. Based on the void capacity and current filling rates it is expected to continue accepting waste until mid 2013. This is based on prudent fill practices and commencing landfilling in cell 4 (50,000m3 void including fill back to existing profiles).

About LandGEM:

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_o \left(\frac{M_i}{10} \right) e^{-kt_{ij}}$$

Where,
Q_{CH4} = annual methane generation in the year of the calculation ($m^3/year$)
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate ($year^{-1}$)
L_o = potential methane generation capacity (m^3/Mg)
M_i = mass of waste accepted in the i^{th} year (Mg)
t_{ij} = age of the j^{th} section of waste mass M_i accepted in the i^{th} year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	**1989**	
Landfill Closure Year (with 80-year limit)	**2010**	
Actual Closure Year (without limit)	***2010***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**411,264**	*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.040**	*year^{-1}*
Potential Methane Generation Capacity, L_o	**100**	*m^3/Mg*
NMOC Concentration	**600**	*ppmv as hexane*
Methane Content	**50**	*% by volume*

GASES / POLLUTANTS SELECTED

Gas / Pollutant #1:	**Total landfill gas**
Gas / Pollutant #2:	**Methane**
Gas / Pollutant #3:	**Carbon dioxide**
Gas / Pollutant #4:	**NMOC**

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
1989	3,700	4,070	0	0
1990	3,700	4,070	3,700	4,070
1991	4,200	4,620	7,400	8,140
1992	4,400	4,840	11,600	12,760
1993	7,000	7,700	16,000	17,600
1994	8,000	8,800	23,000	25,300
1995	12,100	13,310	31,000	34,100
1996	13,300	14,630	43,100	47,410
1997	15,700	17,270	56,400	62,040
1998	13,600	14,960	72,100	79,310
1999	40,000	44,000	85,700	94,270
2000	40,000	44,000	125,700	138,270
2001	41,620	45,782	165,700	182,270
2002	35,800	39,380	207,320	228,052
2003	39,247	43,172	243,120	267,432
2004	23,257	25,583	282,367	310,604
2005	21,507	23,658	305,624	336,186
2006	18,603	20,463	327,131	359,844
2007	18,089	19,898	345,734	380,307
2008	15,812	17,393	363,823	400,205
2009	16,933	18,626	379,635	417,599
2010	14,696	16,166	396,568	436,225
2011	0	0	411,264	452,390
2012	0	0	411,264	452,390
2013	0	0	411,264	452,390
2014	0	0	411,264	452,390
2015	0	0	411,264	452,390
2016	0	0	411,264	452,390
2017	0	0	411,264	452,390
2018	0	0	411,264	452,390
2019	0	0	411,264	452,390
2020	0	0	411,264	452,390
2021	0	0	411,264	452,390
2022	0	0	411,264	452,390
2023	0	0	411,264	452,390
2024	0	0	411,264	452,390
2025	0	0	411,264	452,390
2026	0	0	411,264	452,390
2027	0	0	411,264	452,390
2028	0	0	411,264	452,390

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2029	0	0	411,264	452,390
2030	0	0	411,264	452,390
2031	0	0	411,264	452,390
2032	0	0	411,264	452,390
2033	0	0	411,264	452,390
2034	0	0	411,264	452,390
2035	0	0	411,264	452,390
2036	0	0	411,264	452,390
2037	0	0	411,264	452,390
2038	0	0	411,264	452,390
2039	0	0	411,264	452,390
2040	0	0	411,264	452,390
2041	0	0	411,264	452,390
2042	0	0	411,264	452,390
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2045	0	0	411,264	452,390
2046	0	0	411,264	452,390
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2052	0	0	411,264	452,390
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2060	0	0	411,264	452,390
2061	0	0	411,264	452,390
2062	0	0	411,264	452,390
2063	0	0	411,264	452,390
2064	0	0	411,264	452,390
2065	0	0	411,264	452,390
2066	0	0	411,264	452,390
2067	0	0	411,264	452,390
2068	0	0	411,264	452,390

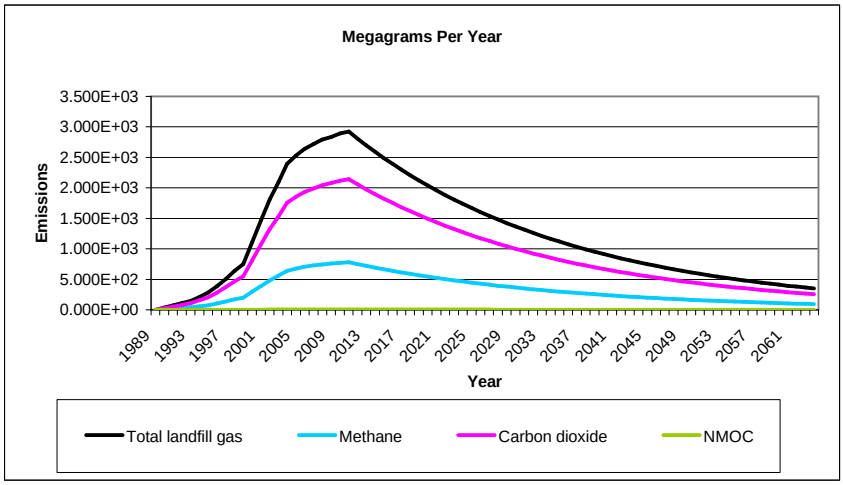
Pollutant Parameters

		Gas / Pollutant Default Parameters:		*User-specified Pollutant Parameters:*	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

Pollutant Parameters (Continued)

		Gas / Pollutant Default Parameters:		***User-specified Pollutant Parameters:***	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Pollutants	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13		
	Ethylbenzene - HAP/VOC	4.6	106.16		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88		
	Fluorotrichloromethane - VOC	0.76	137.38		
	Hexane - HAP/VOC	6.6	86.18		
	Hydrogen sulfide	36	34.08		
	Mercury (total) - HAP	2.9E-04	200.61		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16		
	Methyl mercaptan - VOC	2.5	48.11		
	Pentane - VOC	3.3	72.15		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83		
	Propane - VOC	11	44.09		
	t-1,2-Dichloroethene - VOC	2.8	96.94		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13		
	Toluene - Co-disposal - HAP/VOC	170	92.13		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40		
	Vinyl chloride - HAP/VOC	7.3	62.50		
	Xylenes - HAP/VOC	12	106.16		

Graphs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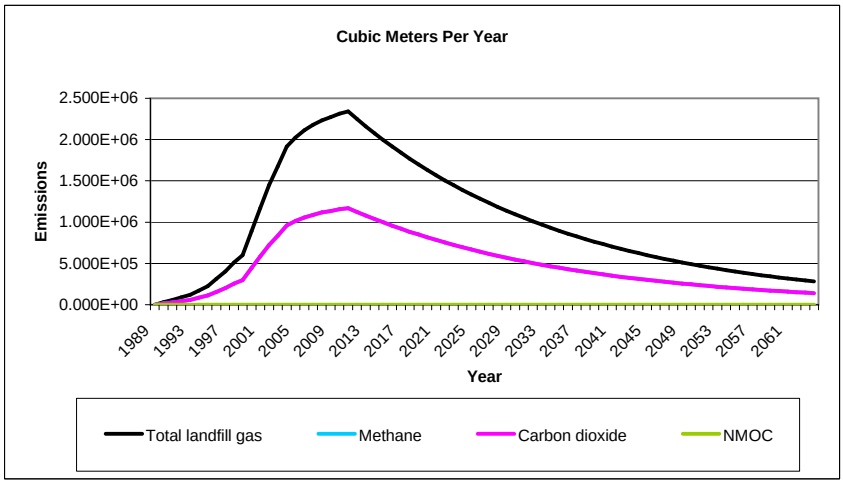
3.000E+03
2.500E+03
2.000E+03
1.500E+03
1.000E+03
5.000E+02
0.000E+00
1989 1993 1997 2001 2005 2009 2013 2017 2021 2025 2029 2033 2037 2041 2045 2049 2053 2057 2061
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
Emissions
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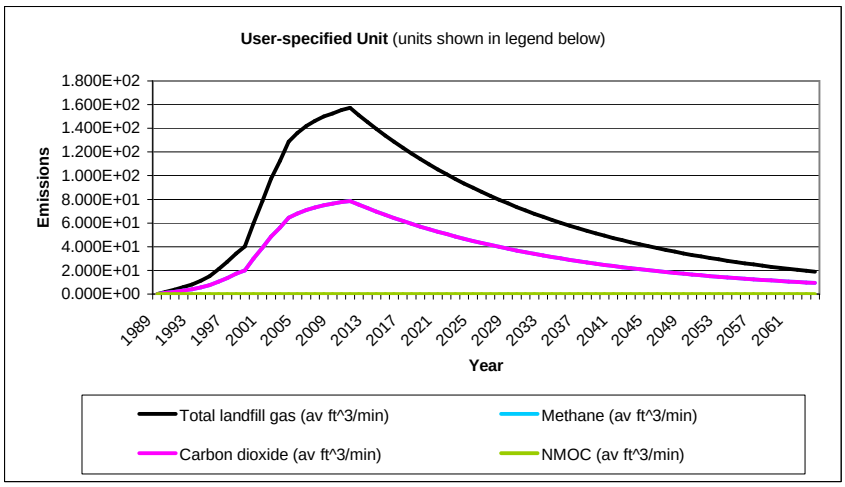
2.000E+06
1.500E+06
1.000E+06
5.000E+05
0.000E+00
1989 1993 1997 2001 2005 2009 2013 2017 2021 2025 2029 2033 2037 2041 2045 2049 2053 2057 2061
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
Emissions
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1.600E+02
1.400E+02
1.200E+02
1.000E+02
8.000E+01
6.000E+01
4.000E+01
2.000E+01
0.000E+00
1989 1993 1997 2001 2005 2009 2013 2017 2021 2025 2029 2033 2037 2041 2045 2049 2053 2057 2061
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Carbon dioxide (av ft^3/min)
NMOC (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
1989	0	0	0	0	0	0
1990	3.631E+01	2.907E+04	1.953E+00	9.698E+00	1.454E+04	9.767E-01
1991	7.119E+01	5.701E+04	3.830E+00	1.902E+01	2.850E+04	1.915E+00
1992	1.096E+02	8.778E+04	5.898E+00	2.928E+01	4.389E+04	2.949E+00
1993	1.485E+02	1.189E+05	7.989E+00	3.966E+01	5.945E+04	3.995E+00
1994	2.114E+02	1.693E+05	1.137E+01	5.646E+01	8.463E+04	5.686E+00
1995	2.816E+02	2.255E+05	1.515E+01	7.521E+01	1.127E+05	7.575E+00
1996	3.893E+02	3.117E+05	2.094E+01	1.040E+02	1.559E+05	1.047E+01
1997	5.045E+02	4.040E+05	2.714E+01	1.348E+02	2.020E+05	1.357E+01
1998	6.388E+02	5.115E+05	3.437E+01	1.706E+02	2.558E+05	1.718E+01
1999	7.472E+02	5.983E+05	4.020E+01	1.996E+02	2.992E+05	2.010E+01
2000	1.110E+03	8.892E+05	5.974E+01	2.966E+02	4.446E+05	2.987E+01
2001	1.459E+03	1.169E+06	7.852E+01	3.898E+02	5.843E+05	3.926E+01
2002	1.811E+03	1.450E+06	9.742E+01	4.836E+02	7.249E+05	4.871E+01
2003	2.091E+03	1.674E+06	1.125E+02	5.585E+02	8.372E+05	5.625E+01
2004	2.394E+03	1.917E+06	1.288E+02	6.395E+02	9.585E+05	6.440E+01
2005	2.528E+03	2.025E+06	1.360E+02	6.754E+02	1.012E+06	6.802E+01
2006	2.640E+03	2.114E+06	1.421E+02	7.053E+02	1.057E+06	7.103E+01
2007	2.719E+03	2.178E+06	1.463E+02	7.264E+02	1.089E+06	7.315E+01
2008	2.790E+03	2.234E+06	1.501E+02	7.453E+02	1.117E+06	7.506E+01
2009	2.836E+03	2.271E+06	1.526E+02	7.575E+02	1.135E+06	7.629E+01
2010	2.891E+03	2.315E+06	1.555E+02	7.722E+02	1.157E+06	7.777E+01
2011	2.922E+03	2.340E+06	1.572E+02	7.804E+02	1.170E+06	7.860E+01
2012	2.807E+03	2.248E+06	1.510E+02	7.498E+02	1.124E+06	7.552E+01
2013	2.697E+03	2.160E+06	1.451E+02	7.204E+02	1.080E+06	7.256E+01
2014	2.591E+03	2.075E+06	1.394E+02	6.922E+02	1.038E+06	6.971E+01
2015	2.490E+03	1.994E+06	1.340E+02	6.651E+02	9.969E+05	6.698E+01
2016	2.392E+03	1.916E+06	1.287E+02	6.390E+02	9.578E+05	6.435E+01
2017	2.298E+03	1.840E+06	1.237E+02	6.139E+02	9.202E+05	6.183E+01
2018	2.208E+03	1.768E+06	1.188E+02	5.898E+02	8.841E+05	5.940E+01
2019	2.122E+03	1.699E+06	1.142E+02	5.667E+02	8.495E+05	5.708E+01
2020	2.038E+03	1.632E+06	1.097E+02	5.445E+02	8.162E+05	5.484E+01
2021	1.959E+03	1.568E+06	1.054E+02	5.231E+02	7.842E+05	5.269E+01
2022	1.882E+03	1.507E+06	1.012E+02	5.026E+02	7.534E+05	5.062E+01
2023	1.808E+03	1.448E+06	9.727E+01	4.829E+02	7.239E+05	4.864E+01
2024	1.737E+03	1.391E+06	9.346E+01	4.640E+02	6.955E+05	4.673E+01
2025	1.669E+03	1.336E+06	8.979E+01	4.458E+02	6.682E+05	4.490E+01
2026	1.604E+03	1.284E+06	8.627E+01	4.283E+02	6.420E+05	4.314E+01
2027	1.541E+03	1.234E+06	8.289E+01	4.115E+02	6.168E+05	4.145E+01
2028	1.480E+03	1.185E+06	7.964E+01	3.954E+02	5.927E+05	3.982E+01
2029	1.422E+03	1.139E+06	7.652E+01	3.799E+02	5.694E+05	3.826E+01
2030	1.366E+03	1.094E+06	7.352E+01	3.650E+02	5.471E+05	3.676E+01
2031	1.313E+03	1.051E+06	7.063E+01	3.507E+02	5.256E+05	3.532E+01
2032	1.261E+03	1.010E+06	6.787E+01	3.369E+02	5.050E+05	3.393E+01
2033	1.212E+03	9.704E+05	6.520E+01	3.237E+02	4.852E+05	3.260E+01
2034	1.164E+03	9.324E+05	6.265E+01	3.110E+02	4.662E+05	3.132E+01
2035	1.119E+03	8.958E+05	6.019E+01	2.988E+02	4.479E+05	3.010E+01
2036	1.075E+03	8.607E+05	5.783E+01	2.871E+02	4.304E+05	2.892E+01
2037	1.033E+03	8.270E+05	5.556E+01	2.759E+02	4.135E+05	2.778E+01
2038	9.922E+02	7.945E+05	5.338E+01	2.650E+02	3.973E+05	2.669E+01

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2039	9.533E+02	7.634E+05	5.129E+01	2.546E+02	3.817E+05	2.565E+01
2040	9.159E+02	7.334E+05	4.928E+01	2.447E+02	3.667E+05	2.464E+01
2041	8.800E+02	7.047E+05	4.735E+01	2.351E+02	3.523E+05	2.367E+01
2042	8.455E+02	6.771E+05	4.549E+01	2.258E+02	3.385E+05	2.275E+01
2043	8.124E+02	6.505E+05	4.371E+01	2.170E+02	3.253E+05	2.185E+01
2044	7.805E+02	6.250E+05	4.199E+01	2.085E+02	3.125E+05	2.100E+01
2045	7.499E+02	6.005E+05	4.035E+01	2.003E+02	3.002E+05	2.017E+01
2046	7.205E+02	5.769E+05	3.877E+01	1.925E+02	2.885E+05	1.938E+01
2047	6.923E+02	5.543E+05	3.725E+01	1.849E+02	2.772E+05	1.862E+01
2048	6.651E+02	5.326E+05	3.578E+01	1.777E+02	2.663E+05	1.789E+01
2049	6.390E+02	5.117E+05	3.438E+01	1.707E+02	2.559E+05	1.719E+01
2050	6.140E+02	4.916E+05	3.303E+01	1.640E+02	2.458E+05	1.652E+01
2051	5.899E+02	4.724E+05	3.174E+01	1.576E+02	2.362E+05	1.587E+01
2052	5.668E+02	4.538E+05	3.049E+01	1.514E+02	2.269E+05	1.525E+01
2053	5.445E+02	4.360E+05	2.930E+01	1.455E+02	2.180E+05	1.465E+01
2054	5.232E+02	4.190E+05	2.815E+01	1.398E+02	2.095E+05	1.407E+01
2055	5.027E+02	4.025E+05	2.705E+01	1.343E+02	2.013E+05	1.352E+01
2056	4.830E+02	3.867E+05	2.599E+01	1.290E+02	1.934E+05	1.299E+01
2057	4.640E+02	3.716E+05	2.497E+01	1.239E+02	1.858E+05	1.248E+01
2058	4.458E+02	3.570E+05	2.399E+01	1.191E+02	1.785E+05	1.199E+01
2059	4.284E+02	3.430E+05	2.305E+01	1.144E+02	1.715E+05	1.152E+01
2060	4.116E+02	3.296E+05	2.214E+01	1.099E+02	1.648E+05	1.107E+01
2061	3.954E+02	3.166E+05	2.127E+01	1.056E+02	1.583E+05	1.064E+01
2062	3.799E+02	3.042E+05	2.044E+01	1.015E+02	1.521E+05	1.022E+01
2063	3.650E+02	2.923E+05	1.964E+01	9.750E+01	1.461E+05	9.820E+00
2064	3.507E+02	2.808E+05	1.887E+01	9.368E+01	1.404E+05	9.435E+00
2065	3.370E+02	2.698E+05	1.813E+01	9.000E+01	1.349E+05	9.065E+00
2066	3.237E+02	2.592E+05	1.742E+01	8.648E+01	1.296E+05	8.709E+00
2067	3.111E+02	2.491E+05	1.674E+01	8.309E+01	1.245E+05	8.368E+00
2068	2.989E+02	2.393E+05	1.608E+01	7.983E+01	1.197E+05	8.040E+00
2069	2.871E+02	2.299E+05	1.545E+01	7.670E+01	1.150E+05	7.724E+00
2070	2.759E+02	2.209E+05	1.484E+01	7.369E+01	1.105E+05	7.421E+00
2071	2.651E+02	2.122E+05	1.426E+01	7.080E+01	1.061E+05	7.130E+00
2072	2.547E+02	2.039E+05	1.370E+01	6.802E+01	1.020E+05	6.851E+00
2073	2.447E+02	1.959E+05	1.316E+01	6.536E+01	9.796E+04	6.582E+00
2074	2.351E+02	1.882E+05	1.265E+01	6.279E+01	9.412E+04	6.324E+00
2075	2.259E+02	1.809E+05	1.215E+01	6.033E+01	9.043E+04	6.076E+00
2076	2.170E+02	1.738E+05	1.168E+01	5.797E+01	8.689E+04	5.838E+00
2077	2.085E+02	1.670E+05	1.122E+01	5.569E+01	8.348E+04	5.609E+00
2078	2.003E+02	1.604E+05	1.078E+01	5.351E+01	8.021E+04	5.389E+00
2079	1.925E+02	1.541E+05	1.036E+01	5.141E+01	7.706E+04	5.178E+00
2080	1.849E+02	1.481E+05	9.949E+00	4.940E+01	7.404E+04	4.975E+00
2081	1.777E+02	1.423E+05	9.559E+00	4.746E+01	7.114E+04	4.780E+00
2082	1.707E+02	1.367E+05	9.185E+00	4.560E+01	6.835E+04	4.592E+00
2083	1.640E+02	1.313E+05	8.824E+00	4.381E+01	6.567E+04	4.412E+00
2084	1.576E+02	1.262E+05	8.478E+00	4.209E+01	6.309E+04	4.239E+00
2085	1.514E+02	1.212E+05	8.146E+00	4.044E+01	6.062E+04	4.073E+00
2086	1.455E+02	1.165E+05	7.827E+00	3.886E+01	5.824E+04	3.913E+00
2087	1.398E+02	1.119E+05	7.520E+00	3.733E+01	5.596E+04	3.760E+00
2088	1.343E+02	1.075E+05	7.225E+00	3.587E+01	5.376E+04	3.612E+00
2089	1.290E+02	1.033E+05	6.942E+00	3.446E+01	5.166E+04	3.471E+00

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2090	1.240E+02	9.926E+04	6.669E+00	3.311E+01	4.963E+04	3.335E+00
2091	1.191E+02	9.537E+04	6.408E+00	3.181E+01	4.768E+04	3.204E+00
2092	1.144E+02	9.163E+04	6.157E+00	3.057E+01	4.581E+04	3.078E+00
2093	1.099E+02	8.804E+04	5.915E+00	2.937E+01	4.402E+04	2.958E+00
2094	1.056E+02	8.458E+04	5.683E+00	2.822E+01	4.229E+04	2.842E+00
2095	1.015E+02	8.127E+04	5.460E+00	2.711E+01	4.063E+04	2.730E+00
2096	9.751E+01	7.808E+04	5.246E+00	2.605E+01	3.904E+04	2.623E+00
2097	9.369E+01	7.502E+04	5.041E+00	2.502E+01	3.751E+04	2.520E+00
2098	9.001E+01	7.208E+04	4.843E+00	2.404E+01	3.604E+04	2.421E+00
2099	8.648E+01	6.925E+04	4.653E+00	2.310E+01	3.463E+04	2.327E+00
2100	8.309E+01	6.654E+04	4.471E+00	2.219E+01	3.327E+04	2.235E+00
2101	7.983E+01	6.393E+04	4.295E+00	2.132E+01	3.196E+04	2.148E+00
2102	7.670E+01	6.142E+04	4.127E+00	2.049E+01	3.071E+04	2.063E+00
2103	7.370E+01	5.901E+04	3.965E+00	1.969E+01	2.951E+04	1.983E+00
2104	7.081E+01	5.670E+04	3.810E+00	1.891E+01	2.835E+04	1.905E+00
2105	6.803E+01	5.448E+04	3.660E+00	1.817E+01	2.724E+04	1.830E+00
2106	6.536E+01	5.234E+04	3.517E+00	1.746E+01	2.617E+04	1.758E+00
2107	6.280E+01	5.029E+04	3.379E+00	1.677E+01	2.514E+04	1.689E+00
2108	6.034E+01	4.832E+04	3.246E+00	1.612E+01	2.416E+04	1.623E+00
2109	5.797E+01	4.642E+04	3.119E+00	1.548E+01	2.321E+04	1.560E+00
2110	5.570E+01	4.460E+04	2.997E+00	1.488E+01	2.230E+04	1.498E+00
2111	5.351E+01	4.285E+04	2.879E+00	1.429E+01	2.143E+04	1.440E+00
2112	5.142E+01	4.117E+04	2.766E+00	1.373E+01	2.059E+04	1.383E+00
2113	4.940E+01	3.956E+04	2.658E+00	1.320E+01	1.978E+04	1.329E+00
2114	4.746E+01	3.801E+04	2.554E+00	1.268E+01	1.900E+04	1.277E+00
2115	4.560E+01	3.652E+04	2.454E+00	1.218E+01	1.826E+04	1.227E+00
2116	4.381E+01	3.508E+04	2.357E+00	1.170E+01	1.754E+04	1.179E+00
2117	4.210E+01	3.371E+04	2.265E+00	1.124E+01	1.685E+04	1.132E+00
2118	4.045E+01	3.239E+04	2.176E+00	1.080E+01	1.619E+04	1.088E+00
2119	3.886E+01	3.112E+04	2.091E+00	1.038E+01	1.556E+04	1.045E+00
2120	3.734E+01	2.990E+04	2.009E+00	9.973E+00	1.495E+04	1.004E+00
2121	3.587E+01	2.872E+04	1.930E+00	9.582E+00	1.436E+04	9.650E-01
2122	3.447E+01	2.760E+04	1.854E+00	9.206E+00	1.380E+04	9.272E-01
2123	3.311E+01	2.652E+04	1.782E+00	8.845E+00	1.326E+04	8.908E-01
2124	3.182E+01	2.548E+04	1.712E+00	8.498E+00	1.274E+04	8.559E-01
2125	3.057E+01	2.448E+04	1.645E+00	8.165E+00	1.224E+04	8.223E-01
2126	2.937E+01	2.352E+04	1.580E+00	7.845E+00	1.176E+04	7.901E-01
2127	2.822E+01	2.260E+04	1.518E+00	7.537E+00	1.130E+04	7.591E-01
2128	2.711E+01	2.171E+04	1.459E+00	7.242E+00	1.085E+04	7.293E-01
2129	2.605E+01	2.086E+04	1.401E+00	6.958E+00	1.043E+04	7.007E-01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
1989	0	0	0	0	0	0
1990	2.661E+01	1.454E+04	9.767E-01	6.253E-02	1.744E+01	1.172E-03
1991	5.218E+01	2.850E+04	1.915E+00	1.226E-01	3.420E+01	2.298E-03
1992	8.034E+01	4.389E+04	2.949E+00	1.888E-01	5.267E+01	3.539E-03
1993	1.088E+02	5.945E+04	3.995E+00	2.557E-01	7.134E+01	4.794E-03
1994	1.549E+02	8.463E+04	5.686E+00	3.640E-01	1.016E+02	6.823E-03
1995	2.064E+02	1.127E+05	7.575E+00	4.849E-01	1.353E+02	9.090E-03
1996	2.853E+02	1.559E+05	1.047E+01	6.704E-01	1.870E+02	1.257E-02
1997	3.698E+02	2.020E+05	1.357E+01	8.689E-01	2.424E+02	1.629E-02
1998	4.682E+02	2.558E+05	1.718E+01	1.100E+00	3.069E+02	2.062E-02
1999	5.476E+02	2.992E+05	2.010E+01	1.287E+00	3.590E+02	2.412E-02
2000	8.138E+02	4.446E+05	2.987E+01	1.912E+00	5.335E+02	3.585E-02
2001	1.070E+03	5.843E+05	3.926E+01	2.513E+00	7.012E+02	4.711E-02
2002	1.327E+03	7.249E+05	4.871E+01	3.118E+00	8.699E+02	5.845E-02
2003	1.532E+03	8.372E+05	5.625E+01	3.601E+00	1.005E+03	6.750E-02
2004	1.755E+03	9.585E+05	6.440E+01	4.123E+00	1.150E+03	7.728E-02
2005	1.853E+03	1.012E+06	6.802E+01	4.354E+00	1.215E+03	8.162E-02
2006	1.935E+03	1.057E+06	7.103E+01	4.547E+00	1.269E+03	8.523E-02
2007	1.993E+03	1.089E+06	7.315E+01	4.683E+00	1.307E+03	8.778E-02
2008	2.045E+03	1.117E+06	7.506E+01	4.805E+00	1.341E+03	9.007E-02
2009	2.078E+03	1.135E+06	7.629E+01	4.884E+00	1.363E+03	9.155E-02
2010	2.119E+03	1.157E+06	7.777E+01	4.979E+00	1.389E+03	9.332E-02
2011	2.141E+03	1.170E+06	7.860E+01	5.032E+00	1.404E+03	9.432E-02
2012	2.057E+03	1.124E+06	7.552E+01	4.835E+00	1.349E+03	9.062E-02
2013	1.977E+03	1.080E+06	7.256E+01	4.645E+00	1.296E+03	8.707E-02
2014	1.899E+03	1.038E+06	6.971E+01	4.463E+00	1.245E+03	8.365E-02
2015	1.825E+03	9.969E+05	6.698E+01	4.288E+00	1.196E+03	8.037E-02
2016	1.753E+03	9.578E+05	6.435E+01	4.120E+00	1.149E+03	7.722E-02
2017	1.684E+03	9.202E+05	6.183E+01	3.958E+00	1.104E+03	7.419E-02
2018	1.618E+03	8.841E+05	5.940E+01	3.803E+00	1.061E+03	7.129E-02
2019	1.555E+03	8.495E+05	5.708E+01	3.654E+00	1.019E+03	6.849E-02
2020	1.494E+03	8.162E+05	5.484E+01	3.511E+00	9.794E+02	6.581E-02
2021	1.435E+03	7.842E+05	5.269E+01	3.373E+00	9.410E+02	6.322E-02
2022	1.379E+03	7.534E+05	5.062E+01	3.241E+00	9.041E+02	6.075E-02
2023	1.325E+03	7.239E+05	4.864E+01	3.114E+00	8.686E+02	5.836E-02
2024	1.273E+03	6.955E+05	4.673E+01	2.992E+00	8.346E+02	5.608E-02
2025	1.223E+03	6.682E+05	4.490E+01	2.874E+00	8.019E+02	5.388E-02
2026	1.175E+03	6.420E+05	4.314E+01	2.762E+00	7.704E+02	5.176E-02
2027	1.129E+03	6.168E+05	4.145E+01	2.653E+00	7.402E+02	4.973E-02
2028	1.085E+03	5.927E+05	3.982E+01	2.549E+00	7.112E+02	4.778E-02
2029	1.042E+03	5.694E+05	3.826E+01	2.449E+00	6.833E+02	4.591E-02
2030	1.001E+03	5.471E+05	3.676E+01	2.353E+00	6.565E+02	4.411E-02
2031	9.622E+02	5.256E+05	3.532E+01	2.261E+00	6.308E+02	4.238E-02
2032	9.244E+02	5.050E+05	3.393E+01	2.172E+00	6.060E+02	4.072E-02
2033	8.882E+02	4.852E+05	3.260E+01	2.087E+00	5.823E+02	3.912E-02
2034	8.534E+02	4.662E+05	3.132E+01	2.005E+00	5.594E+02	3.759E-02
2035	8.199E+02	4.479E+05	3.010E+01	1.927E+00	5.375E+02	3.611E-02
2036	7.878E+02	4.304E+05	2.892E+01	1.851E+00	5.164E+02	3.470E-02
2037	7.569E+02	4.135E+05	2.778E+01	1.779E+00	4.962E+02	3.334E-02
2038	7.272E+02	3.973E+05	2.669E+01	1.709E+00	4.767E+02	3.203E-02

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2039	6.987E+02	3.817E+05	2.565E+01	1.642E+00	4.580E+02	3.077E-02
2040	6.713E+02	3.667E+05	2.464E+01	1.577E+00	4.401E+02	2.957E-02
2041	6.450E+02	3.523E+05	2.367E+01	1.516E+00	4.228E+02	2.841E-02
2042	6.197E+02	3.385E+05	2.275E+01	1.456E+00	4.062E+02	2.729E-02
2043	5.954E+02	3.253E+05	2.185E+01	1.399E+00	3.903E+02	2.622E-02
2044	5.720E+02	3.125E+05	2.100E+01	1.344E+00	3.750E+02	2.520E-02
2045	5.496E+02	3.002E+05	2.017E+01	1.291E+00	3.603E+02	2.421E-02
2046	5.281E+02	2.885E+05	1.938E+01	1.241E+00	3.462E+02	2.326E-02
2047	5.073E+02	2.772E+05	1.862E+01	1.192E+00	3.326E+02	2.235E-02
2048	4.875E+02	2.663E+05	1.789E+01	1.145E+00	3.196E+02	2.147E-02
2049	4.683E+02	2.559E+05	1.719E+01	1.101E+00	3.070E+02	2.063E-02
2050	4.500E+02	2.458E+05	1.652E+01	1.057E+00	2.950E+02	1.982E-02
2051	4.323E+02	2.362E+05	1.587E+01	1.016E+00	2.834E+02	1.904E-02
2052	4.154E+02	2.269E+05	1.525E+01	9.761E-01	2.723E+02	1.830E-02
2053	3.991E+02	2.180E+05	1.465E+01	9.378E-01	2.616E+02	1.758E-02
2054	3.834E+02	2.095E+05	1.407E+01	9.010E-01	2.514E+02	1.689E-02
2055	3.684E+02	2.013E+05	1.352E+01	8.657E-01	2.415E+02	1.623E-02
2056	3.540E+02	1.934E+05	1.299E+01	8.318E-01	2.320E+02	1.559E-02
2057	3.401E+02	1.858E+05	1.248E+01	7.991E-01	2.229E+02	1.498E-02
2058	3.268E+02	1.785E+05	1.199E+01	7.678E-01	2.142E+02	1.439E-02
2059	3.139E+02	1.715E+05	1.152E+01	7.377E-01	2.058E+02	1.383E-02
2060	3.016E+02	1.648E+05	1.107E+01	7.088E-01	1.977E+02	1.329E-02
2061	2.898E+02	1.583E+05	1.064E+01	6.810E-01	1.900E+02	1.276E-02
2062	2.784E+02	1.521E+05	1.022E+01	6.543E-01	1.825E+02	1.226E-02
2063	2.675E+02	1.461E+05	9.820E+00	6.286E-01	1.754E+02	1.178E-02
2064	2.570E+02	1.404E+05	9.435E+00	6.040E-01	1.685E+02	1.132E-02
2065	2.470E+02	1.349E+05	9.065E+00	5.803E-01	1.619E+02	1.088E-02
2066	2.373E+02	1.296E+05	8.709E+00	5.575E-01	1.555E+02	1.045E-02
2067	2.280E+02	1.245E+05	8.368E+00	5.357E-01	1.494E+02	1.004E-02
2068	2.190E+02	1.197E+05	8.040E+00	5.147E-01	1.436E+02	9.647E-03
2069	2.104E+02	1.150E+05	7.724E+00	4.945E-01	1.380E+02	9.269E-03
2070	2.022E+02	1.105E+05	7.421E+00	4.751E-01	1.325E+02	8.906E-03
2071	1.943E+02	1.061E+05	7.130E+00	4.565E-01	1.273E+02	8.557E-03
2072	1.866E+02	1.020E+05	6.851E+00	4.386E-01	1.224E+02	8.221E-03
2073	1.793E+02	9.796E+04	6.582E+00	4.214E-01	1.176E+02	7.899E-03
2074	1.723E+02	9.412E+04	6.324E+00	4.049E-01	1.129E+02	7.589E-03
2075	1.655E+02	9.043E+04	6.076E+00	3.890E-01	1.085E+02	7.291E-03
2076	1.590E+02	8.689E+04	5.838E+00	3.737E-01	1.043E+02	7.006E-03
2077	1.528E+02	8.348E+04	5.609E+00	3.591E-01	1.002E+02	6.731E-03
2078	1.468E+02	8.021E+04	5.389E+00	3.450E-01	9.625E+01	6.467E-03
2079	1.411E+02	7.706E+04	5.178E+00	3.315E-01	9.247E+01	6.213E-03
2080	1.355E+02	7.404E+04	4.975E+00	3.185E-01	8.885E+01	5.970E-03
2081	1.302E+02	7.114E+04	4.780E+00	3.060E-01	8.536E+01	5.736E-03
2082	1.251E+02	6.835E+04	4.592E+00	2.940E-01	8.202E+01	5.511E-03
2083	1.202E+02	6.567E+04	4.412E+00	2.825E-01	7.880E+01	5.295E-03
2084	1.155E+02	6.309E+04	4.239E+00	2.714E-01	7.571E+01	5.087E-03
2085	1.110E+02	6.062E+04	4.073E+00	2.607E-01	7.274E+01	4.888E-03
2086	1.066E+02	5.824E+04	3.913E+00	2.505E-01	6.989E+01	4.696E-03
2087	1.024E+02	5.596E+04	3.760E+00	2.407E-01	6.715E+01	4.512E-03
2088	9.842E+01	5.376E+04	3.612E+00	2.313E-01	6.452E+01	4.335E-03
2089	9.456E+01	5.166E+04	3.471E+00	2.222E-01	6.199E+01	4.165E-03

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2090	9.085E+01	4.963E+04	3.335E+00	2.135E-01	5.956E+01	4.002E-03
2091	8.729E+01	4.768E+04	3.204E+00	2.051E-01	5.722E+01	3.845E-03
2092	8.386E+01	4.581E+04	3.078E+00	1.971E-01	5.498E+01	3.694E-03
2093	8.058E+01	4.402E+04	2.958E+00	1.893E-01	5.282E+01	3.549E-03
2094	7.742E+01	4.229E+04	2.842E+00	1.819E-01	5.075E+01	3.410E-03
2095	7.438E+01	4.063E+04	2.730E+00	1.748E-01	4.876E+01	3.276E-03
2096	7.146E+01	3.904E+04	2.623E+00	1.679E-01	4.685E+01	3.148E-03
2097	6.866E+01	3.751E+04	2.520E+00	1.613E-01	4.501E+01	3.024E-03
2098	6.597E+01	3.604E+04	2.421E+00	1.550E-01	4.325E+01	2.906E-03
2099	6.338E+01	3.463E+04	2.327E+00	1.489E-01	4.155E+01	2.792E-03
2100	6.090E+01	3.327E+04	2.235E+00	1.431E-01	3.992E+01	2.682E-03
2101	5.851E+01	3.196E+04	2.148E+00	1.375E-01	3.836E+01	2.577E-03
2102	5.622E+01	3.071E+04	2.063E+00	1.321E-01	3.685E+01	2.476E-03
2103	5.401E+01	2.951E+04	1.983E+00	1.269E-01	3.541E+01	2.379E-03
2104	5.189E+01	2.835E+04	1.905E+00	1.219E-01	3.402E+01	2.286E-03
2105	4.986E+01	2.724E+04	1.830E+00	1.172E-01	3.269E+01	2.196E-03
2106	4.790E+01	2.617E+04	1.758E+00	1.126E-01	3.140E+01	2.110E-03
2107	4.603E+01	2.514E+04	1.689E+00	1.082E-01	3.017E+01	2.027E-03
2108	4.422E+01	2.416E+04	1.623E+00	1.039E-01	2.899E+01	1.948E-03
2109	4.249E+01	2.321E+04	1.560E+00	9.984E-02	2.785E+01	1.871E-03
2110	4.082E+01	2.230E+04	1.498E+00	9.592E-02	2.676E+01	1.798E-03
2111	3.922E+01	2.143E+04	1.440E+00	9.216E-02	2.571E+01	1.728E-03
2112	3.768E+01	2.059E+04	1.383E+00	8.855E-02	2.470E+01	1.660E-03
2113	3.620E+01	1.978E+04	1.329E+00	8.508E-02	2.373E+01	1.595E-03
2114	3.479E+01	1.900E+04	1.277E+00	8.174E-02	2.280E+01	1.532E-03
2115	3.342E+01	1.826E+04	1.227E+00	7.853E-02	2.191E+01	1.472E-03
2116	3.211E+01	1.754E+04	1.179E+00	7.546E-02	2.105E+01	1.414E-03
2117	3.085E+01	1.685E+04	1.132E+00	7.250E-02	2.023E+01	1.359E-03
2118	2.964E+01	1.619E+04	1.088E+00	6.965E-02	1.943E+01	1.306E-03
2119	2.848E+01	1.556E+04	1.045E+00	6.692E-02	1.867E+01	1.254E-03
2120	2.736E+01	1.495E+04	1.004E+00	6.430E-02	1.794E+01	1.205E-03
2121	2.629E+01	1.436E+04	9.650E-01	6.178E-02	1.723E+01	1.158E-03
2122	2.526E+01	1.380E+04	9.272E-01	5.936E-02	1.656E+01	1.113E-03
2123	2.427E+01	1.326E+04	8.908E-01	5.703E-02	1.591E+01	1.069E-03
2124	2.332E+01	1.274E+04	8.559E-01	5.479E-02	1.529E+01	1.027E-03
2125	2.240E+01	1.224E+04	8.223E-01	5.264E-02	1.469E+01	9.868E-04
2126	2.152E+01	1.176E+04	7.901E-01	5.058E-02	1.411E+01	9.481E-04
2127	2.068E+01	1.130E+04	7.591E-01	4.860E-02	1.356E+01	9.109E-04
2128	1.987E+01	1.085E+04	7.293E-01	4.669E-02	1.303E+01	8.752E-04
2129	1.909E+01	1.043E+04	7.007E-01	4.486E-02	1.252E+01	8.409E-04

APPENDIX 9 METEOROLOGICAL DATA

January 2009

			EvapCalcDaily		PR_Sum24h		TA_24h		TA_24h		TA_24h		RH_24h
date	time	status	evap	status	PR_Sum24	status	Avg	status	Max	status	Min	status	Avg
01/01/2009	23:59:07	VALID	0.810933	VALID	0	VALID	2.50545	VALID	4.60045	VALID	0.716037	VALID	87.5715
02/01/2009	23:59:07	VALID	0.63739	VALID	0	VALID	2.11739	VALID	3.72744	VALID	0.105598	VALID	82.716
03/01/2009	23:59:08	VALID	0.613725	VALID	0	VALID	1.81707	VALID	2.84855	VALID	-0.104337	VALID	78.7697
04/01/2009	23:59:08	VALID	0.367413	VALID	0	VALID	3.35478	VALID	7.73981	VALID	1.33306	VALID	85.9693
05/01/2009	23:59:08	VALID	0.080743	VALID	0	VALID	0.409616	VALID	3.87909	VALID	-2.07719	VALID	94.8204
06/01/2009	23:59:08	VALID	0.075175	VALID	0	VALID	-2.33702	VALID	1.60735	VALID	-6.646	VALID	83.2167
07/01/2009	23:59:08	VALID	0.156398	VALID	0	VALID	-2.8864	VALID	4.27328	VALID	-7.83273	VALID	92.0658
08/01/2009	23:59:07	VALID	-0.007057	VALID	0	VALID	-1.1952	VALID	6.97956	VALID	-6.15867	VALID	89.7607
09/01/2009	23:59:07	VALID	0.253636	VALID	0.2	VALID	3.37781	VALID	7.29625	VALID	-3.12291	VALID	80.0458
10/01/2009	23:59:07	VALID	0.710051	VALID	1	VALID	7.64094	VALID	9.13163	VALID	4.65189	VALID	77.2668
11/01/2009	23:59:07	VALID	1.63672	VALID	8.6	VALID	10.4702	VALID	11.6923	VALID	8.38078	VALID	88.9821
12/01/2009	23:59:07	VALID	0.917836	VALID	1.6	VALID	7.48749	VALID	9.43535	VALID	5.12414	VALID	89.5869
13/01/2009	23:59:07	VALID	0.543148	VALID	0.4	VALID	3.06679	VALID	6.55893	VALID	-1.79949	VALID	91.0822
14/01/2009	23:59:07	VALID	0.235766	VALID	8.4	VALID	6.77876	VALID	10.9987	VALID	-1.20868	VALID	91.0321
15/01/2009	23:59:08	VALID	0.715046	VALID	3.2	VALID	8.82595	VALID	10.6069	VALID	4.27037	VALID	84.5914
16/01/2009	23:59:08	VALID	0.947641	VALID	1.8	VALID	7.12839	VALID	9.21557	VALID	4.13787	VALID	83.838
17/01/2009	23:59:07	INVALID	0	VALID	2.8	INVALID	0	INVALID	0	INVALID	0	INVALID	0
18/01/2009	23:59:08	VALID	0.998648	VALID	6.8	VALID	2.87485	VALID	5.61862	VALID	0.441476	VALID	87.1153
19/01/2009	23:59:08	VALID	0.707585	VALID	10.6	VALID	1.70578	VALID	5.50887	VALID	0.050683	VALID	91.8975
20/01/2009	23:59:08	VALID	0.463551	VALID	2.4	VALID	1.86456	VALID	4.61621	VALID	0.315524	VALID	86.3554
21/01/2009	23:59:08	VALID	0.548593	VALID	2.6	VALID	5.5227	VALID	10.7009	VALID	-0.08173	VALID	90.0227
22/01/2009	23:59:07	VALID	0.621942	VALID	4	VALID	5.68543	VALID	10.4676	VALID	3.46237	VALID	83.8201
23/01/2009	23:59:07	VALID	1.22914	VALID	4.4	VALID	2.33311	VALID	6.76281	VALID	-1.18281	VALID	91.2819
24/01/2009	23:59:07	VALID	0.508641	VALID	5.8	VALID	3.21078	VALID	8.12875	VALID	-1.07632	VALID	90.1085
25/01/2009	23:59:07	VALID	0.666429	VALID	3	VALID	3.36202	VALID	7.8213	VALID	0.493149	VALID	89.8879
26/01/2009	23:59:07	VALID	0.697019	VALID	2.8	VALID	5.7817	VALID	9.24053	VALID	2.86439	VALID	83.9316
27/01/2009	23:59:07	VALID	0.879533	VALID	0.8	VALID	5.69357	VALID	7.86984	VALID	-0.15923	VALID	95.3355
28/01/2009	23:59:07	VALID	0.085009	VALID	0.2	VALID	3.41238	VALID	9.75836	VALID	-2.14492	VALID	92.0884
29/01/2009	23:59:08	VALID	0.440569	VALID	9.8	VALID	7.97655	VALID	11.1064	VALID	6.10996	VALID	90.9818
30/01/2009	23:59:08	VALID	1.01739	VALID	28	VALID	8.03174	VALID	11.2129	VALID	5.33072	VALID	94.1234
31/01/2009	23:59:08	VALID	0.353022	VALID	14.4	VALID	5.44535	VALID	6.65648	VALID	4.5326	VALID	96.8224
TOTAL			**17.91164**		**123.6**								

February 2009

date	time	status	EvapCalcDaily evap	status	PR_Sum24h PR_Sum24	status	TA_24h Avg	status	TA_24h Max	status	TA_24h Min	status	RH_24h Avg
01/02/2009	23:59:08	VALID	0.11367	VALID	0	VALID	2.68697	VALID	4.75518	VALID	1.0519	VALID	80.9712
02/02/2009	23:59:08	VALID	0.762705	VALID	0	VALID	0.149549	VALID	2.16335	VALID	-1.496	VALID	78.7266
03/02/2009	23:59:07	VALID	0.82785	VALID	0.6	VALID	0.403695	VALID	2.18917	VALID	-0.895463	VALID	91.8674
04/02/2009	23:59:07	VALID	0.274727	VALID	2.8	VALID	1.94114	VALID	4.94609	VALID	-0.559674	VALID	91.2559
05/02/2009	23:59:07	VALID	0.420482	VALID	0	VALID	1.14055	VALID	2.9388	VALID	-0.35622	VALID	81.9341
06/02/2009	23:59:07	VALID	0.685371	VALID	0	VALID	0.994163	VALID	4.89752	VALID	-2.39026	VALID	83.3557
07/02/2009	23:59:07	VALID	0.649768	VALID	0	VALID	0.525306	VALID	4.72255	VALID	-2.35141	VALID	80.3365
08/02/2009	23:59:07	VALID	0.777751	VALID	1.4	VALID	2.59624	VALID	8.02043	VALID	-1.40233	VALID	87.0896
09/02/2009	23:59:07	VALID	0.773351	VALID	0	VALID	1.33195	VALID	4.81009	VALID	-1.24085	VALID	89.8816
10/02/2009	23:59:07	VALID	0.296925	VALID	1	VALID	1.508	VALID	6.91477	VALID	-1.95773	VALID	92.2499
11/02/2009	23:59:08	VALID	0.322495	VALID	0	VALID	2.91086	VALID	7.54842	VALID	-2.72254	VALID	91.9406
12/02/2009	23:59:08	VALID	0.201895	VALID	2.6	VALID	6.12141	VALID	9.71665	VALID	2.89359	VALID	94.0754
13/02/2009	23:59:08	VALID	0.215773	VALID	0.2	VALID	6.62549	VALID	10.2794	VALID	1.47816	VALID	90.8349
14/02/2009	23:59:08	VALID	0.243242	VALID	0	VALID	6.95543	VALID	9.84304	VALID	4.77471	VALID	83.4008
15/02/2009	23:59:07	VALID	0.720539	VALID	0.2	VALID	5.27032	VALID	9.96931	VALID	-1.21839	VALID	90.2056
16/02/2009	23:59:07	VALID	0.159074	VALID	0	VALID	5.10126	VALID	9.55777	VALID	-1.27007	VALID	88.3412
17/02/2009	23:59:07	VALID	0.276841	VALID	0	VALID	6.87073	VALID	9.51269	VALID	4.85561	VALID	83.6885
18/02/2009	23:59:07	VALID	0.284916	VALID	0.2	VALID	6.60831	VALID	8.3741	VALID	5.5443	VALID	79.9399
19/02/2009	23:59:07	VALID	0.613768	VALID	1.4	VALID	6.08182	VALID	9.71652	VALID	2.4573	VALID	89.8294
20/02/2009	23:59:07	VALID	0.285226	VALID	0.2	VALID	3.13805	VALID	9.67768	VALID	-2.11238	VALID	89.2628
21/02/2009	23:59:07	VALID	0.336514	VALID	0	VALID	4.63975	VALID	10.7196	VALID	-1.96089	VALID	88.2688
22/02/2009	23:59:08	VALID	0.55667	VALID	0.2	VALID	8.20762	VALID	9.86819	VALID	6.97676	VALID	88.2384
23/02/2009	23:59:08	VALID	0.786607	VALID	0.2	VALID	8.03234	VALID	10.2439	VALID	6.86659	VALID	92.3566
24/02/2009	23:59:08	VALID	0.370083	VALID	0.2	VALID	6.43132	VALID	7.0253	VALID	5.54712	VALID	93.5566
25/02/2009	23:59:08	VALID	0.177997	VALID	0	VALID	6.32937	VALID	9.82984	VALID	1.8918	VALID	82.872
26/02/2009	23:59:08	VALID	0.677927	VALID	0	VALID	6.60369	VALID	10.9958	VALID	1.79822	VALID	85.7367
27/02/2009	23:59:07	VALID	0.682667	VALID	0.2	VALID	7.78658	VALID	9.10828	VALID	6.63657	VALID	85.7428
28/02/2009	23:59:07	VALID	0.976718	VALID	2.8	VALID	7.8221	VALID	10.166	VALID	4.00542	VALID	84.5387
TOTAL			**13.47155**		**14.2**								

March 2009

			EvapCalcDaily		PR_Sum24h		TA_24h		TA_24h		TA_24h		RH_24h
date	time	status	evap	status	PR_Sum24	status	Avg	status	Max	status	Min	status	Avg
01/03/2009	23:59:07	VALID	0.912129	VALID	0.8	VALID	4.95855	VALID	9.45694	VALID	1.20697	VALID	83.9033
02/03/2009	23:59:07	VALID	0.991893	VALID	0.2	VALID	5.47774	VALID	10.3511	VALID	0.338135	VALID	89.2116
03/03/2009	23:59:07	VALID	0.675499	VALID	8.2	VALID	3.5866	VALID	6.80844	VALID	-0.356234	VALID	87.5636
04/03/2009	23:59:07	VALID	0.587529	VALID	5.4	VALID	0.943606	VALID	4.40549	VALID	-1.50573	VALID	92.0121
05/03/2009	23:59:07	VALID	0.544389	VALID	0	VALID	2.92487	VALID	8.40248	VALID	-1.09576	VALID	81.6047
06/03/2009	23:59:07	VALID	1.23141	VALID	1.6	VALID	5.53502	VALID	10.2708	VALID	-0.908355	VALID	87.0619
07/03/2009	23:59:08	VALID	0.639624	VALID	1.8	VALID	8.64327	VALID	13.1872	VALID	2.77386	VALID	83.9774
08/03/2009	23:59:08	VALID	1.33507	VALID	8	VALID	2.70912	VALID	5.71522	VALID	0.428535	VALID	83.5524
09/03/2009	23:59:08	VALID	0.965147	VALID	4.6	VALID	5.64939	VALID	9.24124	VALID	2.10828	VALID	83.509
10/03/2009	23:59:08	VALID	1.13698	VALID	0.4	VALID	8.20162	VALID	10.8072	VALID	6.70824	VALID	83.9299
11/03/2009	23:59:07	VALID	0.874868	VALID	0	VALID	10.2441	VALID	13.7605	VALID	7.13485	VALID	84.8929
12/03/2009	23:59:07	VALID	1.17363	VALID	1	VALID	9.51808	VALID	12.6495	VALID	6.91206	VALID	81.9369
13/03/2009	23:59:07	VALID	1.12426	VALID	0.4	VALID	8.67169	VALID	10.0181	VALID	7.24772	VALID	85.2724
14/03/2009	23:59:07	VALID	0.964412	VALID	0.2	VALID	7.37307	VALID	10.8434	VALID	3.18767	VALID	74.9802
15/03/2009	23:59:07	VALID	1.47827	VALID	0	VALID	6.38288	VALID	11.5963	VALID	-0.314228	VALID	79.593
16/03/2009	23:59:07	VALID	1.24151	VALID	0	VALID	7.89155	VALID	12.3272	VALID	4.3478	VALID	77.5137
17/03/2009	23:59:07	VALID	1.24784	VALID	0	VALID	7.6241	VALID	13.4649	VALID	3.38794	VALID	77.8943
18/03/2009	23:59:08	VALID	1.71858	VALID	0	VALID	7.47207	VALID	14.1215	VALID	4.04067	VALID	86.6725
19/03/2009	23:59:08	VALID	1.30227	VALID	0	VALID	6.77798	VALID	14.439	VALID	1.67527	VALID	84.019
20/03/2009	23:59:08	VALID	1.83706	VALID	0	VALID	7.285	VALID	11.4508	VALID	3.58853	VALID	82.2631
21/03/2009	23:59:08	VALID	0.983967	VALID	0	VALID	5.77948	VALID	12.432	VALID	-0.895361	VALID	84.3621
22/03/2009	23:59:08	VALID	0.832415	VALID	0	VALID	7.37873	VALID	12.3302	VALID	1.68509	VALID	82.3124
23/03/2009	23:59:07	VALID	1.05808	VALID	0.4	VALID	7.91651	VALID	10.8274	VALID	3.10032	VALID	79.6632
24/03/2009	23:59:07	VALID	1.55797	VALID	1.4	VALID	6.32402	VALID	10.5585	VALID	0.354248	VALID	85.2779
25/03/2009	23:59:07	VALID	0.856474	VALID	0	VALID	8.10856	VALID	10.7481	VALID	6.28455	VALID	75.632
26/03/2009	23:59:07	VALID	1.72026	VALID	4.6	VALID	6.96931	VALID	9.14724	VALID	3.18092	VALID	78.6404
27/03/2009	23:59:07	VALID	1.74492	VALID	4.6	VALID	4.26316	VALID	7.18329	VALID	2.10187	VALID	83.9976
28/03/2009	23:59:07	VALID	0.949531	VALID	0.2	VALID	4.72724	VALID	8.20153	VALID	0.008698	VALID	60.4289
29/03/2009	23:59:08	VALID	2.20246	VALID	1	VALID	5.35216	VALID	9.31187	VALID	0.412376	VALID	83.645
30/03/2009	23:59:08	VALID	0.929061	VALID	0.4	VALID	8.29933	VALID	12.564	VALID	2.27942	VALID	86.8474
31/03/2009	23:59:08	VALID	0.512253	VALID	0	VALID	7.17706	VALID	13.7912	VALID	0.906534	VALID	85.121
Total			**35.32976**		**45.2**								

April 2009

			EvapCalcDaily		PR_Sum24h		TA_24h		TA_24h		TA_24h		RH_24h
date	time	status	evap	status	PR_Sum24	status	Avg	status	Max	status	Min	status	Avg
01/04/2009	23:59:08	VALID	0.927806	VALID	0	VALID	7.41719	VALID	11.3369	VALID	2.87405	VALID	80.1988
02/04/2009	23:59:08	VALID	0.887791	VALID	0	VALID	8.52937	VALID	16.4026	VALID	1.55913	VALID	75.0634
03/04/2009	23:59:08	VALID	1.69313	VALID	7	VALID	7.09224	VALID	9.69783	VALID	1.97573	VALID	90.6483
04/04/2009	23:59:07	VALID	0.543103	VALID	0	VALID	6.72142	VALID	10.9329	VALID	0.334879	VALID	76.1494
05/04/2009	23:59:07	VALID	1.54976	VALID	0.2	VALID	6.17941	VALID	11.7666	VALID	-0.081728	VALID	78.5595
06/04/2009	23:59:07	VALID	1.43352	VALID	3.8	VALID	7.6821	VALID	11.7161	VALID	3.17139	VALID	79.7879
07/04/2009	23:59:07	VALID	1.44239	VALID	1	VALID	6.97644	VALID	10.6933	VALID	3.47526	VALID	81.9792
08/04/2009	23:59:07	VALID	1.42237	VALID	0.8	VALID	8.74972	VALID	13.7566	VALID	4.74866	VALID	75.3968
09/04/2009	23:59:07	VALID	2.10218	VALID	6.6	VALID	9.1498	VALID	11.3003	VALID	5.33395	VALID	91.3898
10/04/2009	23:59:08	VALID	0.628396	VALID	1.4	VALID	5.72016	VALID	11.0337	VALID	0.189554	VALID	83.2478
11/04/2009	23:59:08	VALID	1.1894	VALID	1.4	VALID	5.62938	VALID	11.7239	VALID	-1.26033	VALID	84.5666
12/04/2009	23:59:08	VALID	0.909138	VALID	0	VALID	8.14474	VALID	12.4935	VALID	2.14057	VALID	70.0666
13/04/2009	23:59:08	VALID	1.70314	VALID	2.4	VALID	9.39669	VALID	13.3165	VALID	6.97676	VALID	64.0998
14/04/2009	23:59:08	VALID	2.56318	VALID	2.2	VALID	8.51455	VALID	11.9657	VALID	5.83194	VALID	65.27
15/04/2009	23:59:08	VALID	2.21592	VALID	3.2	VALID	8.59733	VALID	10.1344	VALID	6.27153	VALID	67.6181
16/04/2009	23:59:07	VALID	1.63763	VALID	1	VALID	9.70507	VALID	11.9308	VALID	8.36449	VALID	64.7527
17/04/2009	23:59:07	VALID	2.25906	VALID	1.2	VALID	8.59088	VALID	9.7555	VALID	6.8735	VALID	66.6968
18/04/2009	23:59:07	VALID	1.56229	VALID	0	VALID	9.66923	VALID	14.7364	VALID	4.91356	VALID	56.0723
19/04/2009	23:59:07	VALID	2.83901	VALID	0	VALID	9.13589	VALID	16.4202	VALID	1.64632	VALID	62.1218
20/04/2009	23:59:07	VALID	1.70518	VALID	0	VALID	9.31328	VALID	15.1902	VALID	2.08238	VALID	67.2567
21/04/2009	23:59:07	VALID	1.8246	VALID	0	VALID	10.78	VALID	15.2127	VALID	5.01666	VALID	65.0681
22/04/2009	23:59:08	VALID	2.40004	VALID	0.2	VALID	9.555	VALID	13.9575	VALID	3.99542	VALID	74.9672
23/04/2009	23:59:08	VALID	2.43765	VALID	4.4	VALID	10.0274	VALID	15.5373	VALID	7.40986	VALID	72.2594
24/04/2009	23:59:08	VALID	2.03793	VALID	7	VALID	8.4321	VALID	10.8943	VALID	7.10268	VALID	70.1425
25/04/2009	23:59:08	VALID	1.36243	VALID	9.2	VALID	8.051	VALID	11.7978	VALID	5.19826	VALID	62.4216
26/04/2009	23:59:08	VALID	2.88745	VALID	2.8	VALID	8.4237	VALID	10.2063	VALID	6.74664	VALID	50.816
27/04/2009	23:59:07	VALID	2.62965	VALID	5.6	VALID	6.60692	VALID	10.7068	VALID	3.88879	VALID	53.932
28/04/2009	23:59:07	VALID	2.11376	VALID	5.2	VALID	7.46171	VALID	12.1086	VALID	3.41384	VALID	48.5628
29/04/2009	23:59:07	VALID	1.66359	VALID	5	VALID	8.71927	VALID	10.9088	VALID	4.82632	VALID	42.3746
30/04/2009	23:59:07	VALID	1.93702	VALID	0.6	VALID	10.1486	VALID	16.2058	VALID	6.53048	VALID	42.2374
TOTAL			**52.50851**		**72.2**								

May 2009

			EvapCalcDaily		PR_Sum24h		TA_24h		TA_24h		TA_24h		RH_24h
date	time	status	evap	status	PR_Sum24	status	Avg	status	Max	status	Min	status	Avg
01/05/2009	23:59:07	VALID	2.68452	VALID	2.2	VALID	10.3946	VALID	14.5047	VALID	5.83812	VALID	42.875
02/05/2009	23:59:07	VALID	3.91165	VALID	2.4	VALID	8.99249	VALID	14.2818	VALID	3.96006	VALID	40.202
03/05/2009	23:59:07	VALID	3.06749	VALID	0.6	VALID	7.27464	VALID	11.645	VALID	1.00019	VALID	41.929
04/05/2009	23:59:08	VALID	2.18471	VALID	0.2	VALID	9.60538	VALID	11.7719	VALID	6.40416	VALID	38.8974
05/05/2009	23:59:08	VALID	3.59106	VALID	0	VALID	11.7233	VALID	15.133	VALID	9.1662	VALID	39.3551
06/05/2009	23:59:08	VALID	4.31422	VALID	2.2	VALID	11.1506	VALID	15.7758	VALID	6.94109	VALID	43.6944
07/05/2009	23:59:08	VALID	4.34622	VALID	1.6	VALID	7.80063	VALID	11.7457	VALID	4.49039	VALID	39.2391
08/05/2009	23:59:08	VALID	4.05486	VALID	2.8	VALID	7.74595	VALID	11.7321	VALID	4.56136	VALID	38.1298
09/05/2009	23:59:07	VALID	3.9244	VALID	1.4	VALID	8.71284	VALID	13.2568	VALID	5.37613	VALID	37.0235
10/05/2009	23:59:07	VALID	3.60117	VALID	0	VALID	9.33748	VALID	14.6689	VALID	4.04745	VALID	37.0398
11/05/2009	23:59:07	VALID	2.47252	VALID	0	VALID	10.7199	VALID	16.2103	VALID	5.36602	VALID	35.8212
12/05/2009	23:59:07	VALID	4.25782	VALID	0	VALID	9.71758	VALID	15.4503	VALID	3.90197	VALID	36.665
13/05/2009	23:59:07	VALID	3.4414	VALID	0.8	VALID	8.25962	VALID	9.68378	VALID	6.43982	VALID	46.3295
14/05/2009	23:59:07	VALID	2.17895	VALID	16.6	VALID	9.73679	VALID	15.9746	VALID	7.42262	VALID	44.4858
15/05/2009	23:59:07	VALID	2.55729	VALID	1	VALID	8.45741	VALID	11.3739	VALID	5.89964	VALID	38.9146
16/05/2009	23:59:08	VALID	2.61229	VALID	7.2	VALID	8.32195	VALID	11.0858	VALID	5.65054	VALID	33.3807
17/05/2009	23:59:08	VALID	4.39375	VALID	7	VALID	8.82519	VALID	12.5531	VALID	5.59268	VALID	30.5081
18/05/2009	23:59:08	VALID	3.83539	VALID	6.2	VALID	9.87496	VALID	12.443	VALID	7.90171	VALID	28.6247
19/05/2009	23:59:08	VALID	4.95776	VALID	5.4	VALID	9.8567	VALID	15.2856	VALID	6.7211	VALID	29.9725
20/05/2009	23:59:08	VALID	4.50928	VALID	5	VALID	9.91751	VALID	13.6781	VALID	6.64652	VALID	31.6176
21/05/2009	23:59:07	VALID	1.80378	VALID	1	VALID	9.58669	VALID	14.2515	VALID	4.75578	VALID	33.6914
22/05/2009	23:59:07	VALID	2.7528	VALID	1.4	VALID	13.0064	VALID	19.1417	VALID	8.68481	VALID	42.3074
23/05/2009	23:59:07	VALID	4.41496	VALID	5.2	VALID	10.9927	VALID	14.4988	VALID	5.81261	VALID	43.3801
24/05/2009	23:59:07	VALID	2.83626	VALID	0	VALID	12.1256	VALID	19.0286	VALID	2.50257	VALID	46.0535
25/05/2009	23:59:07	INVALID	0	VALID	0.6	VALID	11.5555	VALID	16.1511	VALID	5.91912	VALID	52.4669
26/05/2009	23:59:07	VALID	1.98423	VALID	1.4	VALID	9.22837	VALID	13.9571	VALID	3.40441	VALID	40.2515
27/05/2009	23:59:07	VALID	3.04755	VALID	8	VALID	11.6058	VALID	13.8714	VALID	8.58447	VALID	37.1458
28/05/2009	23:59:07	VALID	4.14622	VALID	0	VALID	14.9138	VALID	20.4882	VALID	10.8663	VALID	40.8135
29/05/2009	23:59:08	VALID	3.136	VALID	0	VALID	13.1846	VALID	17.2485	VALID	7.91495	VALID	46.7346
30/05/2009	23:59:08	VALID	3.72581	VALID	0	VALID	15.1236	VALID	19.9588	VALID	8.10517	VALID	49.7581
31/05/2009	23:59:08	VALID	3.90261	VALID	0	VALID	15.3469	VALID	22.2237	VALID	6.16218	VALID	49.6336
TOTAL			**102.647**		**80.2**								

June 2009

			EvapCalcDaily		PR_Sum24h		TA_24h		TA_24h		TA_24h		RH_24h
date	time	status	evap	status	PR_Sum24h	status	Avg	status	Max	status	Min	status	Avg
01/06/2009	23:59:08	VALID	2.99032	VALID	0	VALID	16.3597	VALID	23.8689	VALID	5.74454	VALID	45.2348
02/06/2009	23:59:08	VALID	3.25015	VALID	0	VALID	18.7043	VALID	26.501	VALID	8.14765	VALID	35.4478
03/06/2009	23:59:07	VALID	3.639	VALID	0	VALID	17.7857	VALID	24.982	VALID	10.3294	VALID	34.6323
04/06/2009	23:59:07	VALID	4.97499	VALID	0	VALID	14.4159	VALID	19.8707	VALID	8.06705	VALID	38.3605
05/06/2009	23:59:07	VALID	3.16954	VALID	0	VALID	12.0388	VALID	16.6238	VALID	7.30318	VALID	37.7932
06/06/2009	23:59:07	VALID	3.92736	VALID	9.2	VALID	7.85414	VALID	11.8622	VALID	5.75388	VALID	42.5516
07/06/2009	23:59:07	VALID	4.22005	VALID	0	VALID	10.8511	VALID	15.2659	VALID	7.58811	VALID	33.8979
08/06/2009	23:59:07	VALID	4.59028	VALID	0	VALID	10.809	VALID	14.0192	VALID	8.16697	VALID	30.4195
09/06/2009	23:59:08	VALID	4.53633	VALID	0.6	VALID	11.9028	VALID	14.8914	VALID	9.25766	VALID	26.8066
10/06/2009	23:59:08	VALID	4.11706	VALID	3.4	VALID	11.1664	VALID	16.9818	VALID	6.5401	VALID	26.8969
11/06/2009	23:59:08	VALID	2.7392	VALID	0	VALID	11.0044	VALID	17.1366	VALID	4.82016	VALID	25.8876
12/06/2009	23:59:08	VALID	2.61129	VALID	0.8	VALID	13.8155	VALID	19.9239	VALID	9.02725	VALID	22.8379
13/06/2009	23:59:08	VALID	6.15873	VALID	10.6	VALID	13.5836	VALID	18.8247	VALID	9.35095	VALID	25.3387
14/06/2009	23:59:08	VALID	5.3708	VALID	9.2	VALID	13.239	VALID	17.0711	VALID	9.57804	VALID	24.7242
15/06/2009	23:59:07	VALID	4.69576	VALID	9.6	VALID	13.6336	VALID	18.967	VALID	9.44495	VALID	23.6224
16/06/2009	23:59:07	VALID	3.27335	VALID	5	VALID	14.1009	VALID	20.0355	VALID	8.79755	VALID	25.3505
17/06/2009	23:59:07	VALID	5.42137	VALID	14.4	VALID	12.5719	VALID	15.548	VALID	8.79487	VALID	27.4026
18/06/2009	23:59:07	VALID	4.61821	VALID	0.2	VALID	11.6114	VALID	15.8655	VALID	8.41023	VALID	25.8605
19/06/2009	23:59:07	VALID	5.18195	VALID	0.2	VALID	11.9467	VALID	15.3926	VALID	9.28367	VALID	24.06
20/06/2009	23:59:07	VALID	4.36311	VALID	0	VALID	13.6404	VALID	17.1555	VALID	11.0509	VALID	22.7922
21/06/2009	23:59:07	VALID	4.90919	VALID	0	VALID	15.4555	VALID	20.8494	VALID	11.5655	VALID	22.6453
22/06/2009	23:59:08	VALID	4.59623	VALID	0	VALID	18.2962	VALID	23.9082	VALID	13.7098	VALID	26.3107
23/06/2009	23:59:08	VALID	3.27738	VALID	0	VALID	18.9401	VALID	23.6064	VALID	14.5946	VALID	29.6487
24/06/2009	23:59:08	VALID	5.37538	VALID	0	VALID	16.9936	VALID	20.5004	VALID	12.3723	VALID	26.7448
25/06/2009	23:59:08	VALID	5.23817	VALID	0	VALID	17.0008	VALID	21.633	VALID	12.1167	VALID	23.6628
26/06/2009	23:59:07	VALID	5.77073	VALID	4.2	VALID	16.1907	VALID	21.1018	VALID	11.5659	VALID	21.3235
27/06/2009	23:59:07	VALID	5.1948	VALID	0	VALID	15.5323	VALID	20.8256	VALID	10.63	VALID	20.4813
28/06/2009	23:59:07	VALID	5.49712	VALID	3.2	VALID	14.6562	VALID	17.0795	VALID	11.9468	VALID	20.7281
29/06/2009	23:59:07	VALID	5.29161	VALID	0	VALID	15.6079	VALID	22.0613	VALID	7.04183	VALID	21.5479
30/06/2009	23:59:07	VALID	4.568	VALID	0.8	VALID	16.4027	VALID	19.4168	VALID	13.6384	VALID	22.0783
Total			**133.5675**		**71.4**								

July 2009

			EvapCalcDaily		MET Shannon Airport	PR_Sum24h		TA_24h		TA_24h		TA_24h		RH_24h
date	time	status	evap	status	PR_Sum24h	PR_Sum24	status	Avg	status	Max	status	Min	status	Avg
01/07/2009	23:59:07	VALID	5.84566	VALID		3.4	VALID	17.2883	VALID	19.7072	VALID	14.9995	VALID	22.2436
02/07/2009	23:59:07	VALID	4.75671	VALID		7.6	VALID	16.0323	VALID	17.416	VALID	14.8077	VALID	25.8718
03/07/2009	23:59:07	VALID	4.57916	VALID		0.2	VALID	16.4147	VALID	20.5517	VALID	13.6092	VALID	27.9216
04/07/2009	23:59:08	VALID	6.95528	VALID		2	VALID	15.122	VALID	19.2056	VALID	12.1193	VALID	42.158
05/07/2009	23:59:08	VALID	5.38163	VALID		8.8	VALID	13.4359	VALID	18.0065	VALID	9.37108	VALID	40.0334
06/07/2009	23:59:08	VALID	3.82933	VALID		31	VALID	11.4045	VALID	15.2543	VALID	9.26472	VALID	39.6703
07/07/2009	23:59:08	VALID	2.49022	VALID		1.8	VALID	14.1096	VALID	18.4529	VALID	10.448	VALID	36.8985
08/07/2009	23:59:07	VALID	3.98835	VALID		0	VALID	13.6376	VALID	17.2774	VALID	9.32334	VALID	34.6428
09/07/2009	23:59:07	VALID	2.60077	VALID		0	VALID	13.4066	VALID	18.4921	VALID	8.1155	VALID	33.628
10/07/2009	23:59:07	VALID	2.05933	VALID		6.8	VALID	12.7943	VALID	16.1167	VALID	8.9286	VALID	33.7527
11/07/2009	23:59:07	VALID	2.15238	VALID		11	VALID	14.6781	VALID	16.4809	VALID	13.4823	VALID	42.5154
12/07/2009	23:59:07	VALID	4.36146	VALID		2.4	VALID	14.1719	VALID	18.4895	VALID	11.0472	VALID	41.0849
13/07/2009	23:59:07	VALID	5.46563	VALID		4.6	VALID	13.3206	VALID	17.6128	VALID	9.30333	VALID	36.587
14/07/2009	23:59:07	VALID	3.88728	VALID		8.8	VALID	13.2987	VALID	17.9013	VALID	9.41029	VALID	33.2416
15/07/2009	23:59:08	VALID	3.41019	VALID		0.2	VALID	13.7634	VALID	19.8023	VALID	8.51434	VALID	31.7962
16/07/2009	23:59:08	VALID	3.04555	VALID		0	VALID	13.443	VALID	18.6372	VALID	8.55956	VALID	32.229
17/07/2009	23:59:08	VALID	2.46554	VALID		0	VALID	13.4238	VALID	17.9483	VALID	8.88952	VALID	30.2417
18/07/2009	23:59:08	VALID	4.53863	VALID		4	VALID	12.3229	VALID	15.8696	VALID	10.1092	VALID	28.8455
19/07/2009	23:59:08	VALID	3.03875	VALID		1	VALID	13.5318	VALID	18.2052	VALID	9.92784	VALID	28.1798
20/07/2009	23:59:07	VALID	4.15266	VALID		0	VALID	13.7016	VALID	19.0665	VALID	8.57854	VALID	28.1216
21/07/2009	23:59:07	VALID	4.98029	VALID		5.8	VALID	14.4062	VALID	19.0655	VALID	11.3009	VALID	30.2028
22/07/2009	23:59:07	VALID	6.29415	VALID		2.2	VALID	13.9887	VALID	17.9198	VALID	10.9122	VALID	32.0987
23/07/2009	23:59:07	VALID	4.41505	VALID		7.2	VALID	13.0237	VALID	18.1069	VALID	10.3163	VALID	31.6403
24/07/2009	23:59:07	VALID	3.91823	VALID		5.2	VALID	13.076	VALID	18.6831	VALID	8.0801	VALID	28.7283
25/07/2009	23:59:07	VALID	2.97987	VALID	5.4	2.6	VALID	13.3743	VALID	18.9858	VALID	6.78631	VALID	28.3369
26/07/2009	23:59:07	VALID	5.12701	VALID	4.9	1.8	VALID	14.1996	VALID	17.1483	VALID	11.4495	VALID	29.9828
27/07/2009	23:59:07	VALID	6.43976	VALID	1.3	43.6	VALID	13.7707	VALID	25.1709	VALID	10.2485	VALID	25.377
28/07/2009	23:59:08	VALID	7.42363	VALID	3	2.4	INVALID	0	INVALID	0	INVALID	0	VALID	4
29/07/2009	23:59:08	INVALID	7.42363	VALID	4.1	0.4	INVALID	0	INVALID	0	INVALID	0	VALID	4
30/07/2009	23:59:08	INVALID	7.42363	VALID	4	2.8	INVALID	0	INVALID	0	INVALID	0	VALID	4
31/07/2009	23:59:08	INVALID	7.42363	VALID	7.8	3.4	INVALID	0	INVALID	0	INVALID	0	VALID	4
TOTAL					**30.5**	**127.4**								
			142.8534			**128.7**								

Note: the total 128.7 is the sum minus 43.6.
The Shannon Airport Met Eireann figure is being used for the 27/07/09 as the weatherstation was being serviced on this day and a false high rainfall reading was recorded as a result.

			EvapCalcDaily		PR_Sum24h		TA_24h		TA_24h		TA_24h		RH_24h
date	time	status	evap	status	PR_Sum24	status	Avg	status	Max	status	Min	status	Avg
01/08/2009	23:59:08	INVALID	7.42363	VALID	1.2	INVALID	0	INVALID	0	INVALID	0	VALID	4
02/08/2009	23:59:07	INVALID	7.42363	VALID	2.6	INVALID	0	INVALID	0	INVALID	0	VALID	4
03/08/2009	23:59:07	INVALID	7.42363	VALID	4.4	INVALID	0	INVALID	0	INVALID	0	VALID	4
04/08/2009	23:59:07	INVALID	7.42363	VALID	0	INVALID	0	INVALID	0	INVALID	0	VALID	4
05/08/2009	23:59:07	INVALID	7.42363	VALID	0	INVALID	0	INVALID	0	INVALID	0	VALID	4
06/08/2009	23:59:07	INVALID	7.42363	VALID	0	INVALID	0	INVALID	0	INVALID	0	VALID	4
07/08/2009	23:59:07	INVALID	7.42363	VALID	0	INVALID	0	INVALID	0	INVALID	0	VALID	4
08/08/2009	23:59:07	INVALID	7.42363	VALID	0.4	INVALID	0	INVALID	0	INVALID	0	VALID	4
09/08/2009	23:59:08	INVALID	7.42363	VALID	0.4	INVALID	0	INVALID	0	INVALID	0	VALID	4
10/08/2009	23:59:08	INVALID	7.42363	VALID	2.2	INVALID	0	INVALID	0	INVALID	0	VALID	4
11/08/2009	23:59:08	INVALID	7.42363	VALID	0.2	INVALID	0	INVALID	0	INVALID	0	VALID	4
12/08/2009	23:59:08	INVALID	7.42363	VALID	2.2	INVALID	0	INVALID	0	INVALID	0	VALID	4
13/08/2009	23:59:08	INVALID	7.42363	VALID	0	INVALID	0	INVALID	0	INVALID	0	VALID	4
14/08/2009	23:59:07	INVALID	7.42363	VALID	1.2	INVALID	0	INVALID	0	INVALID	0	VALID	4
15/08/2009	23:59:07	INVALID	7.42363	VALID	5.2	INVALID	0	INVALID	0	INVALID	0	VALID	4
16/08/2009	23:59:07	INVALID	7.42363	VALID	0	INVALID	0	INVALID	0	INVALID	0	VALID	4
17/08/2009	23:59:07	INVALID	7.42363	VALID	0.6	INVALID	0	INVALID	0	INVALID	0	VALID	4
18/08/2009	23:59:07	INVALID	7.42363	VALID	1	INVALID	0	INVALID	0	INVALID	0	VALID	4
19/08/2009	23:59:07	INVALID	7.42363	VALID	8.8	INVALID	0	INVALID	0	INVALID	0	VALID	4
20/08/2009	23:59:07	INVALID	7.42363	VALID	9	INVALID	0	INVALID	0	INVALID	0	VALID	4
21/08/2009	23:59:08	INVALID	7.42363	VALID	0.4	INVALID	0	INVALID	0	INVALID	0	VALID	4
22/08/2009	23:59:08	INVALID	7.42363	VALID	2	INVALID	0	INVALID	0	INVALID	0	VALID	4
23/08/2009	23:59:08	INVALID	7.42363	VALID	4.4	INVALID	0	INVALID	0	INVALID	0	VALID	4
24/08/2009	23:59:08	INVALID	7.42363	VALID	1	INVALID	0	INVALID	0	INVALID	0	VALID	4
25/08/2009	23:59:08	INVALID	0	VALID	11.4	INVALID	0	INVALID	0	INVALID	0	INVALID	0
26/08/2009	23:59:08	VALID	2.16308	VALID	4.8	VALID	15.2732	VALID	18.214	VALID	10.7866	VALID	88.6638
27/08/2009	23:59:08	VALID	0.097071	VALID	1.8	VALID	12.2297	VALID	17.5939	VALID	7.69254	VALID	86.5818
28/08/2009	23:59:07	VALID	0.062344	VALID	15.8	VALID	11.6366	VALID	14.9949	VALID	9.82809	VALID	86.5374
29/08/2009	23:59:07	VALID	0.162131	VALID	0	VALID	11.828	VALID	17.259	VALID	5.65758	VALID	84.2815
30/08/2009	23:59:07	VALID	0.061923	VALID	4.4	VALID	15.1003	VALID	18.7174	VALID	9.67181	VALID	94.9978
31/08/2009	23:59:07	VALID	0.095418	VALID	10.2	VALID	14.8469	VALID	16.9623	VALID	10.1743	VALID	90.9531
TOTAL			**180.8091**		**95.6**								

			EvapCalcDaily		PR_Sum24h		TA_24h		TA_24h		TA_24h		RH_24h
date	time	status	evap	status	PR_Sum24	status	Avg	status	Max	status	Min	status	Avg
01/09/2009	23:59:07	VALID	0.021226	VALID	1.2	VALID	11.9541	VALID	16.231	VALID	8.33265	VALID	87.1477
02/09/2009	23:59:07	VALID	0.098681	VALID	14.4	VALID	11.0763	VALID	12.8583	VALID	8.66314	VALID	95.4766
03/09/2009	23:59:07	VALID	0.008718	VALID	4.8	VALID	10.6202	VALID	13.8816	VALID	8.73726	VALID	90.2386
04/09/2009	23:59:08	VALID	0.090399	VALID	2.6	VALID	10.5473	VALID	15.4592	VALID	7.11975	VALID	88.5506
05/09/2009	23:59:08	VALID	0.137112	VALID	0	VALID	12.1267	VALID	15.1536	VALID	8.66325	VALID	84.672
06/09/2009	23:59:08	VALID	0.050089	VALID	6	VALID	13.6707	VALID	16.1947	VALID	11.6054	VALID	89.7402
07/09/2009	23:59:08	VALID	0.020742	VALID	0.2	VALID	13.7008	VALID	17.1466	VALID	8.89254	VALID	89.185
08/09/2009	23:59:08	VALID	0.058305	VALID	4.2	VALID	14.2862	VALID	17.6778	VALID	7.89329	VALID	92.2156
09/09/2009	23:59:08	INVALID	0	VALID	3.6	INVALID	0	INVALID	0	INVALID	0	INVALID	0
10/09/2009	23:59:08	VALID	0.104753	VALID	0	VALID	11.3613	VALID	19.1392	VALID	3.15542	VALID	84.7954
11/09/2009	23:59:07	VALID	0.062465	VALID	0	VALID	12.7255	VALID	19.86	VALID	6.15579	VALID	82.9721
12/09/2009	23:59:07	VALID	-0.005273	VALID	0	VALID	12.0059	VALID	20.3778	VALID	4.40014	VALID	86.0649
13/09/2009	23:59:07	VALID	0.017974	VALID	0	VALID	12.6484	VALID	20.6391	VALID	3.84715	VALID	82.9481
14/09/2009	23:59:07	VALID	-0.003799	VALID	0	VALID	12.2054	VALID	16.0784	VALID	6.35652	VALID	87.2309
15/09/2009	23:59:07	VALID	-0.015453	VALID	0	VALID	11.6576	VALID	15.1605	VALID	5.42863	VALID	85.5537
16/09/2009	23:59:07	VALID	-0.022281	VALID	0	VALID	12.7754	VALID	17.2926	VALID	9.32299	VALID	88.0415
17/09/2009	23:59:07	VALID	0.050998	VALID	0	VALID	10.9238	VALID	14.2753	VALID	7.17736	VALID	84.7575
18/09/2009	23:59:08	VALID	0.001902	VALID	0	VALID	11.8152	VALID	16.054	VALID	8.72487	VALID	77.6534
19/09/2009	23:59:08	VALID	0.461511	VALID	0.8	VALID	11.6738	VALID	15.844	VALID	4.38715	VALID	80.5163
20/09/2009	23:59:08	VALID	0.933796	VALID	0	VALID	9.55279	VALID	16.5632	VALID	1.35568	VALID	90.6557
21/09/2009	23:59:08	VALID	0.498815	VALID	0	VALID	13.6793	VALID	17.6044	VALID	10.0414	INVALID	0
22/09/2009	23:59:08	VALID	-0.004508	VALID	1	VALID	13.3059	VALID	15.7662	VALID	9.2032	INVALID	0
23/09/2009	23:59:07	VALID	-0.223808	VALID	0	VALID	11.8912	VALID	17.6503	VALID	5.64773	INVALID	0
24/09/2009	23:59:07	VALID	0.150125	VALID	0	VALID	11.055	VALID	16.4373	VALID	5.45705	INVALID	0
25/09/2009	23:59:07	VALID	0.18042	VALID	0	VALID	13.5752	VALID	17.9954	VALID	10.9254	VALID	92.9659
26/09/2009	23:59:07	VALID	0.800386	VALID	0	VALID	13.5625	VALID	16.8095	VALID	11.6818	VALID	95.891
27/09/2009	23:59:07	VALID	0.386944	VALID	0	VALID	13.1637	VALID	16.3046	VALID	11.2034	VALID	95.3049
28/09/2009	23:59:07	VALID	0.432904	VALID	0.6	VALID	12.7408	VALID	14.7274	VALID	11.8065	VALID	94.9012
29/09/2009	23:59:07	VALID	0.279148	VALID	0	VALID	12.767	VALID	17.7257	VALID	9.17672	INVALID	0
30/09/2009	23:59:08	VALID	0.568403	VALID	0	VALID	12.0123	VALID	16.67	VALID	6.799	VALID	88.686
total			**5.140694**		**39.4**								

October 2009

			EvapCalcDaily		PR_Sum24h		TA_24h		TA_24h		TA_24h		RH_24h
date	time	status	evap	status	PR_Sum24	status	Avg	status	Max	status	Min	status	Avg
01/10/2009	23:59:08	VALID	0.507445	VALID	0.6	VALID	10.8122	VALID	13.7165	VALID	8.79185	VALID	92.0112
02/10/2009	23:59:08	VALID	0.354811	VALID	1.4	VALID	10.6713	VALID	13.9983	VALID	6.93497	VALID	85.2817
03/10/2009	23:59:08	VALID	0.565723	VALID	1.8	VALID	10.5759	VALID	12.5726	VALID	7.4206	VALID	89.2786
04/10/2009	23:59:08	VALID	0.462508	VALID	0.2	VALID	9.41981	VALID	13.8642	VALID	6.64388	INVALID	0
05/10/2009	23:59:07	VALID	0.394571	VALID	0	VALID	9.90959	VALID	14.8515	VALID	4.83321	VALID	77.0456
06/10/2009	23:59:07	VALID	0.773438	VALID	37.2	VALID	10.4478	VALID	12.9261	VALID	5.16004	VALID	78.7693
07/10/2009	23:59:07	VALID	0.719973	VALID	0	VALID	6.44723	VALID	13.2616	VALID	0.586884	VALID	78.2225
08/10/2009	23:59:07	VALID	0.376118	VALID	0	VALID	9.12259	VALID	14.5104	VALID	4.19288	VALID	77.5093
09/10/2009	23:59:07	VALID	0.654868	VALID	12.4	VALID	10.9743	VALID	16.2269	VALID	7.24909	VALID	75.3065
10/10/2009	23:59:07	VALID	1.41511	VALID	0.2	VALID	11.0764	VALID	16.3388	VALID	6.59526	VALID	82.8662
11/10/2009	23:59:07	VALID	0.640918	VALID	6	VALID	12.0669	VALID	15.9355	VALID	4.97532	VALID	83.8527
12/10/2009	23:59:08	VALID	0.743939	VALID	0	VALID	8.02571	VALID	14.9906	VALID	0.806444	VALID	84.509
13/10/2009	23:59:08	VALID	0.522049	VALID	0.2	VALID	12.0611	VALID	15.248	VALID	9.42983	VALID	81.0547
14/10/2009	23:59:08	VALID	0.55355	VALID	0	VALID	11.9035	VALID	17.1565	VALID	9.37132	VALID	80.4928
15/10/2009	23:59:08	VALID	0.617761	VALID	0	VALID	11.2146	VALID	12.8481	VALID	10.2292	VALID	85.8205
16/10/2009	23:59:08	VALID	0.171275	VALID	0.2	VALID	11.0216	VALID	15.1235	VALID	6.81832	VALID	85.8617
17/10/2009	23:59:07	VALID	0.439267	VALID	0	VALID	7.94432	VALID	14.0779	VALID	1.49134	VALID	85.3109
18/10/2009	23:59:07	VALID	0.528144	VALID	0.8	VALID	11.0754	VALID	13.5348	VALID	9.24818	VALID	80.2291
19/10/2009	23:59:07	VALID	0.998838	VALID	1.6	VALID	11.1127	VALID	12.5249	VALID	9.93171	VALID	78.0747
20/10/2009	23:59:07	VALID	1.5467	VALID	7	VALID	10.297	VALID	13.4995	VALID	6.41111	VALID	79.5163
21/10/2009	23:59:07	VALID	1.18851	VALID	18.6	VALID	10.3154	VALID	13.0205	VALID	6.78963	VALID	79.3287
22/10/2009	23:59:07	VALID	1.7178	VALID	2.8	VALID	10.6372	VALID	15.8442	VALID	8.06736	VALID	78.6427
23/10/2009	23:59:08	VALID	1.56249	VALID	0.4	VALID	10.6448	VALID	13.4668	VALID	7.44621	VALID	77.8593
24/10/2009	23:59:08	VALID	0.920067	VALID	11	VALID	12.5946	VALID	14.9417	VALID	10.3779	VALID	79.3419
25/10/2009	23:59:08	VALID	1.58518	VALID	0.8	VALID	11.13	VALID	13.6609	VALID	8.66281	VALID	74.4728
26/10/2009	23:59:08	VALID	1.7834	VALID	0.6	VALID	9.93203	VALID	14.1712	VALID	4.85915	VALID	78.7366
27/10/2009	23:59:08	VALID	0.994755	VALID	4.4	VALID	13.9376	VALID	14.9349	VALID	13.0521	VALID	71.8845
28/10/2009	23:59:07	VALID	2.64173	VALID	0	VALID	13.6922	VALID	16.6172	VALID	11.402	VALID	74.5774
29/10/2009	23:59:07	VALID	2.1795	VALID	0.2	VALID	14.0504	VALID	14.92	VALID	12.3759	VALID	77.2752
30/10/2009	23:59:07	VALID	1.78658	VALID	11.2	VALID	14.3155	VALID	15.5771	VALID	10.9697	VALID	78.3305
31/10/2009	23:59:07	VALID	1.61192	VALID	3.6	VALID	12.7012	VALID	15.7707	VALID	10.5926	VALID	85.7234
TOTAL			**30.95894**		**123.2**								

			EvapCalcDaily		PR_Sum24h		TA_24h		TA_24h		TA_24h		RH_24h
date	time	status	evap	status	PR_Sum24	status	Avg	status	Max	status	Min	status	Avg
01/11/2009	23:59:07	VALID	0.997148	VALID	29.4	VALID	8.57404	VALID	12.3152	VALID	4.78178	VALID	88.9042
02/11/2009	23:59:07	VALID	0.598137	VALID	4	VALID	7.55826	VALID	10.5045	VALID	5.11165	VALID	85.9188
03/11/2009	23:59:07	VALID	0.72114	VALID	8.2	VALID	8.19831	VALID	11.0748	VALID	5.23099	VALID	63.843
04/11/2009	23:59:08	VALID	2.06376	VALID	11	VALID	7.29464	VALID	10.557	VALID	5.32485	VALID	59.8399
05/11/2009	23:59:08	INVALID	0	VALID	0	VALID	7.53579	VALID	9.84478	VALID	4.45516	VALID	56.4649
06/11/2009	23:59:08	VALID	1.99461	VALID	8.8	VALID	6.63416	VALID	10.2002	VALID	3.11364	VALID	64.4272
07/11/2009	23:59:08	VALID	1.93006	VALID	11.2	VALID	5.8952	VALID	8.45231	VALID	3.53039	VALID	66.2602
08/11/2009	23:59:08	VALID	1.75452	VALID	0	VALID	7.22285	VALID	11.3295	VALID	3.55001	VALID	64.388
09/11/2009	23:59:07	VALID	1.38092	VALID	17.4	VALID	6.35317	VALID	8.87255	VALID	2.26038	VALID	72.6211
10/11/2009	23:59:07	VALID	0.689711	VALID	0.2	VALID	5.26205	VALID	10.7011	VALID	-0.156024	VALID	75.4754
11/11/2009	23:59:07	VALID	0.82042	VALID	8.2	VALID	4.4869	VALID	10.1678	VALID	-1.7319	VALID	74.1585
12/11/2009	23:59:07	VALID	1.13735	VALID	5.4	VALID	7.62234	VALID	10.6799	VALID	4.55853	VALID	62.0266
13/11/2009	23:59:07	VALID	1.96738	VALID	16	VALID	5.36617	VALID	7.21314	VALID	2.3605	VALID	66.9406
14/11/2009	23:59:07	VALID	1.32737	VALID	5.2	VALID	6.89659	VALID	9.72447	VALID	1.95339	VALID	66.6815
15/11/2009	23:59:07	VALID	1.44003	VALID	5.8	VALID	9.30127	VALID	11.7595	VALID	5.04659	VALID	61.7917
16/11/2009	23:59:07	VALID	2.29799	VALID	11.4	VALID	8.15699	VALID	10.1903	VALID	6.02601	VALID	74.0437
17/11/2009	23:59:08	VALID	1.61717	VALID	0.6	VALID	7.26384	VALID	9.84328	VALID	4.14778	VALID	76.7517
18/11/2009	23:59:08	VALID	1.37534	VALID	7	VALID	11.7883	VALID	12.8971	VALID	9.24229	VALID	69.8662
19/11/2009	23:59:08	VALID	2.61688	VALID	25.4	VALID	13.0347	VALID	13.6652	VALID	10.7959	VALID	79.6553
20/11/2009	23:59:08	VALID	1.69057	VALID	0.2	VALID	9.10781	VALID	11.3047	VALID	5.67037	INVALID	0
21/11/2009	23:59:07	VALID	0.073361	VALID	13.4	VALID	10.5063	VALID	13.3939	VALID	7.89583	INVALID	0
22/11/2009	23:59:07	VALID	0.294395	VALID	5	VALID	6.73363	VALID	8.76651	VALID	4.42244	INVALID	0
23/11/2009	23:59:07	INVALID	0.294395	VALID	10.2	VALID	8.15537	VALID	9.77964	VALID	6.35604	INVALID	0
24/11/2009	23:59:07	INVALID	0.294395	VALID	11.8	VALID	9.11171	VALID	12.0167	VALID	4.82376	INVALID	0
25/11/2009	23:59:07	INVALID	0.294395	VALID	1.4	VALID	6.08228	VALID	8.66907	VALID	4.51014	INVALID	0
26/11/2009	23:59:07	INVALID	0.294395	VALID	2.8	VALID	4.74715	VALID	6.88652	VALID	3.2979	VALID	97.2246
27/11/2009	23:59:07	VALID	0.140125	VALID	3.8	VALID	3.60792	VALID	5.52504	VALID	1.44938	VALID	98.4177
28/11/2009	23:59:08	VALID	0.023918	VALID	1.8	VALID	1.13943	VALID	2.91008	VALID	-1.2798	VALID	99.2494
29/11/2009	23:59:08	VALID	0.006957	VALID	3.8	VALID	3.28109	VALID	5.41528	VALID	0.483514	VALID	99.8054
30/11/2009	23:59:08	VALID	0.126172	VALID	0	VALID	1.04626	VALID	4.77129	VALID	-2.38706	VALID	88.0778
TOTAL			**30.26301**		**229.4**								

December 2009

			EvapCalcDaily		PR_Sum24h		TA_24h		TA_24h		TA_24h		RH_24h
date	time	status	evap	status	PR_Sum24	status	Avg	status	Max	status	Min	status	Avg
01/12/2009	23:59:08	VALID	0.240832	VALID	1.6	VALID	4.73393	VALID	9.35189	VALID	-2.20967	VALID	86.3524
02/12/2009	23:59:08	VALID	0.808204	VALID	0	VALID	7.12752	VALID	8.94444	VALID	5.42161	VALID	87.3113
03/12/2009	23:59:07	VALID	0.441456	VALID	4.6	VALID	2.77317	VALID	6.43732	VALID	0.095902	VALID	96.5803
04/12/2009	23:59:07	VALID	0.177032	VALID	8.6	VALID	5.59846	VALID	10.5141	VALID	-0.805159	VALID	98.4035
05/12/2009	23:59:07	VALID	0.324968	VALID	2	VALID	8.05049	VALID	11.625	VALID	5.34069	VALID	91.5396
06/12/2009	23:59:07	VALID	0.685179	VALID	1.2	VALID	5.65524	VALID	7.48542	VALID	4.2673	VALID	89.6354
07/12/2009	23:59:07	VALID	0.643917	VALID	3	VALID	5.76879	VALID	7.86063	VALID	3.15227	VALID	93.3276
08/12/2009	23:59:07	VALID	0.364071	VALID	0.8	VALID	8.37034	VALID	11.9425	VALID	3.6566	VALID	91.5877
09/12/2009	23:59:07	VALID	0.651293	VALID	1	VALID	7.57078	VALID	9.16748	VALID	4.38057	VALID	90.7081
10/12/2009	23:59:08	VALID	0.481767	VALID	0	VALID	3.02128	VALID	5.94733	VALID	-2.91638	VALID	95.5224
11/12/2009	23:59:08	VALID	0.103456	VALID	0.2	VALID	5.42476	VALID	7.31196	VALID	2.59603	VALID	92.253
12/12/2009	23:59:08	VALID	0.441556	VALID	0	VALID	2.17944	VALID	3.64307	VALID	0.034534	VALID	92.4406
13/12/2009	23:59:08	VALID	0.228328	VALID	0	VALID	-0.131835	VALID	2.77696	VALID	-3.23904	VALID	91.7258
14/12/2009	23:59:08	VALID	0.089314	VALID	0	VALID	-1.65607	VALID	2.79627	VALID	-4.61042	VALID	99.3471
15/12/2009	23:59:07	VALID	0.014724	VALID	0.4	VALID	4.03254	VALID	5.34352	VALID	2.52218	VALID	93.7437
16/12/2009	23:59:07	VALID	0.224599	VALID	0	VALID	3.10206	VALID	5.86443	VALID	-0.772789	VALID	95.439
17/12/2009	23:59:07	VALID	0.117447	VALID	0	VALID	2.97256	VALID	5.65793	VALID	-0.130174	VALID	88.8013
18/12/2009	23:59:07	VALID	0.364802	VALID	0	VALID	-0.797984	VALID	1.41703	VALID	-2.3517	VALID	79.9046
19/12/2009	23:59:07	VALID	0.526794	VALID	0.6	VALID	0.044366	VALID	4.2771	VALID	-4.00107	VALID	91.6231
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25/12/2009	23:59:08	VALID	-0.025231	VALID	0.2	VALID	-2.49609	VALID	3.84402	VALID	-9.2057	VALID	98.7578
26/12/2009	23:59:08	VALID	-0.010164	VALID	1.4	VALID	3.32532	VALID	6.96094	VALID	0.118504	VALID	90.2714
27/12/2009	23:59:07	VALID	0.512201	VALID	0.2	VALID	2.12616	VALID	5.38563	VALID	-3.18749	VALID	92.0753
28/12/2009	23:59:07	VALID	0.269737	VALID	0.2	VALID	-0.559967	VALID	2.49614	VALID	-4.60092	VALID	97.4209
29/12/2009	23:59:07	VALID	0.090987	VALID	16.8	VALID	1.82633	VALID	3.38824	VALID	0.354279	VALID	94.3726
30/12/2009	23:59:07	VALID	0.332633	VALID	7.6	VALID	1.97884	VALID	2.83541	VALID	0.60299	VALID	96.046
31/12/2009	23:59:07	VALID	0.30333	VALID	0	VALID	1.46003	VALID	3.07146	VALID	-2.51293	VALID	83.9506
TOTAL			**8.84549**		**50.6**								

APPENDIX 10 SLOPE STABILITY

ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

SLOPE STABILITY REPORT

DONOHILL LANDFILL FOR NON HAZARDOUS WASTE. GARRYSHANE, DONOHILL, CO. TIPPERARY

WASTE LICENCE REGISTER W0074-02

COPY

MARCH 2010

FEHILY TIMONEY & COMPANY

SLOPE STABILITY REPORT

DONOHILL LANDFILL FOR NON HAZARDOUS WASTE. GARRYSHANE, DONOHILL, CO. TIPPERARY

WASTE LICENCE REGISTER W0074-02
ORIGINAL

MARCH 2010

FEHILY TIMONEY & COMPANY

SLOPE STABILITY REPORT

DONOHILL LANDFILL FOR NON HAZARDOUS WASTE. GARRYSHANE, DONOHILL, CO. TIPPERARY

WASTE LICENCE REGISTER W0074-02

User is Responsible for Checking the Revision Status of This Document

Rev. Nr.	Description of Changes	Prepared by:	Checked by:	Approved by:	Date:
0	Issue to Client	AG/MT	PEC		03.03.10

Client: Tipperary County Council

Keywords: Donohill, landfill, capping, slope stability, peat

Abstract: Tipperary County Council retained FTC to carry out a slope stability analysis of the landfill side slopes in order to comply with condition 8.8.1 of waste Licence 74-2.

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1 INTRODUCTION

1.1 Purpose

This report presents the results of a slope stability assessment carried out for Donohill Landfill for Non-Hazardous Waste Facility. This is in accordance with condition 8.8.1 of the EPA waste licence issued to the site (reference: 74-2).

1.2 Background

A previous failure occurred in February 2004 within the area of the landfill located in the southeast and situated on peat and soft silt. This failure was documented in the Fehily Timoney & Company (FTC) report entitled "Geotechnical Assessment of Existing Situation, Donohill Landfill" dated June 2004.

Subsequent slope stability assessments of the site have been carried out by FTC. These studies found that some of the active and interim slopes analysed did not meet the required long term Factor of Safety (FoS) and concluded that in order to maintain the minimum interim and long term factors of safety or greater, leachate levels must be regularly monitored to prevent a build up within the waste body and cause potential instability of the landfill slopes. The reports recommended that leachate levels should be maintained within 1 m of the toe of slope to prevent instability of the landfill embankments.

The analyses undertaken for this slope stability report have been updated based on the updated topographical profile and using leachate measurements taken throughout 2009.

A site visit was undertaken on 25 February 2010 by a senior engineering geologist from FTC. No evidence of instability or any other causes for concern were noted during the site visit.

1.3 Slope Stability Analysis Method

SLOPE/W software of GEO-SLOPE International Ltd. was used to assess the stability of Donohill Landfill Facility's waste embankments. SLOPE/W is a general software tool for the slope stability analysis of earth structures. It uses the limit equilibrium method of analysis by using the idea of dissecting a potential sliding mass into vertical slices. It assesses the factor of safety for both moment and force equilibrium based on various methods, including Bishops, Janbu and Morgenstern-Price.

Using this software, it is possible to deal with complex stratigraphy, highly irregular pore-water pressure conditions, a variety of linear and nonlinear shear strength models, virtually any kind of slip surface shape, concentrated loads and pressure lines. Limit equilibrium formulations based on the method of slices are also being applied more and more to the stability analysis of structures such as tieback walls, nail or fabric reinforced slopes, and even the sliding stability of structures subjected to high horizontal loading arising, for example, from ice flows.

Traditionally, the factor of safety is defined as that factor by which the shear strength of the soil must be reduced in order to bring the mass of soil into a state of limiting equilibrium along a selected slip surface. The results of the analysis show the overall stability of the embankment expressed as a factor of safety. The definition of factor of safety used within SLOPE/W is:

$$F = \frac{\text{Available restoring moment (or forces)}}{\text{Total disturbing moment (or forces)}}$$

1.4 Limitations of Slope Stability Analyses

Updated shear strength parameters for the landfill waste has been estimated based on parameters used by Kolsch (1995).

Leachate in landfills may occur in irregular perched bodies as opposed to interconnected liquid bodies. For the purposes of this analysis, a general leachate level has been considered in analyses.

1.5 Factors controlling the stability of Landfill Slopes

The factors controlling the stability of landfill slopes are:

- Slope geometry
- Geology
- Properties of the landfill wastes
- Properties of the supporting soil
- Leachate levels within the waste
- Groundwater levels in the supporting soil
- Surcharge

2 DESIGN CRITERIA

2.1 Slope Geometry

Using the latest topographical survey prepared by Focus Surveys Ltd. and presented on Drawing No. 01-072-1L, dated October 2009, typical cross-sections through the waste slopes of the site were taken at the locations shown on Drawing LW10-024-01-001 Rev A. The side slopes analysed were a combination of the existing slopes and the most recently filled areas representing the active slopes on site.

Slope A-A is approximately 10 m high, 140 m long and has a maximum slope of 1:3.5 along the upper part of the slope. Slope B-B is approximately 10 m high and 110 m long, with a maximum slope of 1:5.5. Slope C-C is approximately 6 m high and 100 m long, with a maximum slope of 1:4.1. Slopes B-B and C-C are considered to be permanently capped slopes while slope A-A is a combination of both temporarily capped and active slopes.

2.2 Geology

Previous site investigations show that the site is underlain predominantly by sand and gravel. It is also known that boulder clay is present to the south west while peat is present to the south east. This has been taken into account in the analyses of the slopes in these areas.

The slope cross-sections were created in Slope/W with the underside of the waste being near elevation 94 mAOD. The material beneath the waste in sections B-B and C-C were modelled as sand and gravel. Slope A-A was modelled with the waste overlying consolidated peat and silt, underlain by sand and gravel. The toe of this slope was modelled through the active part of the landfill which is contained by a clay liner.

The slope failure that occurred in February 2004 was previously modelled close to Slope A-A.

2.3 Waste Parameters

Table 2.1 below shows published and derived parameters used for the landfill waste materials.

Table 2.1: Characteristic Parameters for Waste materials

Material	Old Waste	Fresh Waste	Waste Parameters derived from failure
Cohesion (c')	10 kN/m^2	10 kN/m^2	1 kN/m^2
Effective friction angle (ϕ')	22°	15°	22°
Unit weight γ	11 kN/m^3	9.5 kN/m^3	10 kN/m^3

The parameters shown are typical values taken from published papers on the properties of waste. The old waste parameters are considered appropriate for the analysis of slopes B-B and C-C. Although the parameters for fresh waste may be considered appropriate for the remaining slope, in order to model the worst case scenario, the waste parameters derived previously by back-analysis at the location of the failure have been used in the analysis for Slope A-A.

Design values for use in the slope stability analyisis have been derived using IS EN-1997-1 Design Approach 3. This design approach is considered to be the most logical approach for slope stability analysis as it includes partial factors for both material properties and variable loads (for example traffic loads). Table 2.2 shows the partial factors have been applied to the characteristic values to give the derived parameters used during the SlopeW analysis as presented in Table 2.3.

Table 2.2: Partial Factors Used to Derive Design Parameters

Set	Partial Factor		Parameter
M2	$\gamma_{c'}$	1.25	Effective cohesion
	$\gamma_{\square'}$	1.25	Effective angle of friction
	γ_{γ}	1	Soil density
A2	γ_{Q}	1.3	Traffic Loading (variable unfavourable)
R3	$\gamma_{R;e}$	1	Earth resistance

Table 2.3: Design Parameters for Waste materials

Material	Old Waste	Fresh Waste	Waste Parameters derived from failure
Cohesion (c')	8 kN/m^2	8 kN/m^2	0.8 kN/m^2
Effective friction angle (ϕ')	17.6°	12°	17.6°
Unit weight γ	11 kN/m^3	9.5 kN/m^3	10 kN/m^3

2.4 Properties of the supporting soil and capping layers

Table 2.4 below shows the typical parameters used for the capping, underlying peat, clay, sand and gravel.

Table 2.4: Characteristic Parameters for Typical Supporting Materials

Material	Consolidated Peat	Consolidated Silt	Clay Liner	Temporary Clay Capping	Sand and Gravel
Cohesion, c', kN/m^2	0	0	4	4	0
Effective Friction angle, ϕ', °	15	24	29	29	35
Bulk unit weight, γ, kN/m^3	11	18	18	18	21

Table 2.5 shows the design parameters which have been derived using the partial factors given in Table 2.2.

Table 2.5: Design Parameters for Typical Supporting Materials

Material	Consolidated Peat	Consolidated Silt	Clay Liner	Clay Capping	Sand and Gravel
Cohesion, c', kN/m^2	0	0	3.2	3.2	0
Effective Friction angle, ϕ', °	12	19.2	23.2	24	28
Bulk unit weight, γ, kN/m^3	11	18	18	20	21

2.5 Leachate levels within the waste material

Leachate levels were measured within the waste body throughout 2009 at four separate monitoring points (L2 to L5). The leachate height within the landfill was found to vary between zero (at the base of the waste) and a maximum of 8.1 m above the base of the waste.

The leachate levels adopted for the analyses presented in this report are considered to be typical (1 m above the base of the waste) and maximum levels (8.1 m above the base of the waste) appropriate to the particular slopes using 2009 monitoring data.

2.6 Surcharge

A surcharge 20 kN/m^2 has been assumed to the top of the slopes during the analyses to simulate vehicular movement. Applying a partial factor of 1.3 as per IS EN 1997-1 Design Approach 3 (variable, unfavourable action), a design load of 26 kN/m^2 has been applied to the models.

3 RESULTS

3.1 Slope Stability Analyses

Slope stability models were run for three representative sections to assess the slope stability of the landfill waste embankment. The results of the analyses are summarised in Table 3.1 with factors of safety calculated for Bishop, Janbu and Morgenstern-Price methods of analyses. The table also gives the location of each slope, the waste parameters applied, the leachate level simulated, and the length of the relevant slip.

A typical analysis carried out for each of the slopes is presented in Figures 3.1 to 3.3.

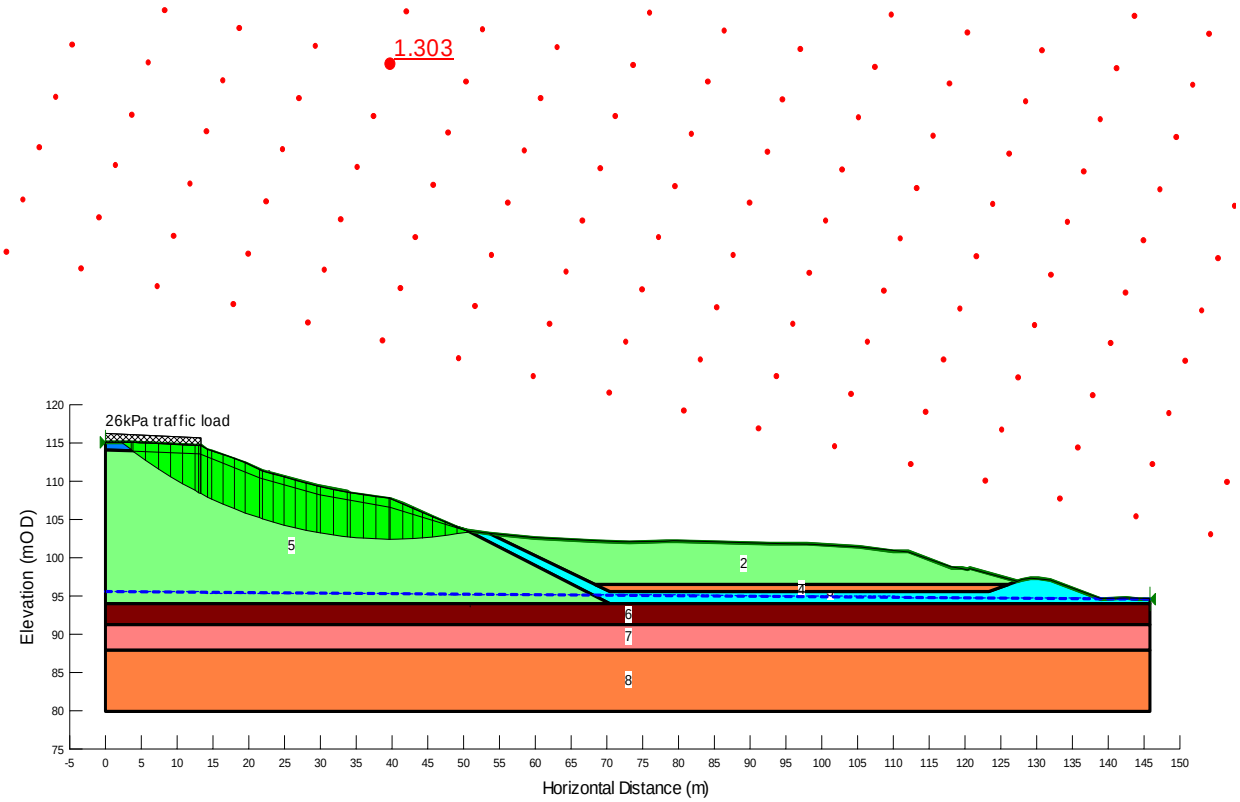
3.2 Factors of Safety

Factors of safety for potential slope failures ranged from 0.79 to 2.10. By adopting the methods of analysis given in IS EN 1997-1, the factor of safety against failure is included in the partial factors applied to the analysis rather than to the end result. Hence, a factor of safety of below 1.0 indicates that the slope has an insufficient factor of safety against failure. A factor of safety of greater than 1.0 indicates that the slope is considered stable.

Table 3.1: Slope Analyses Results Summary

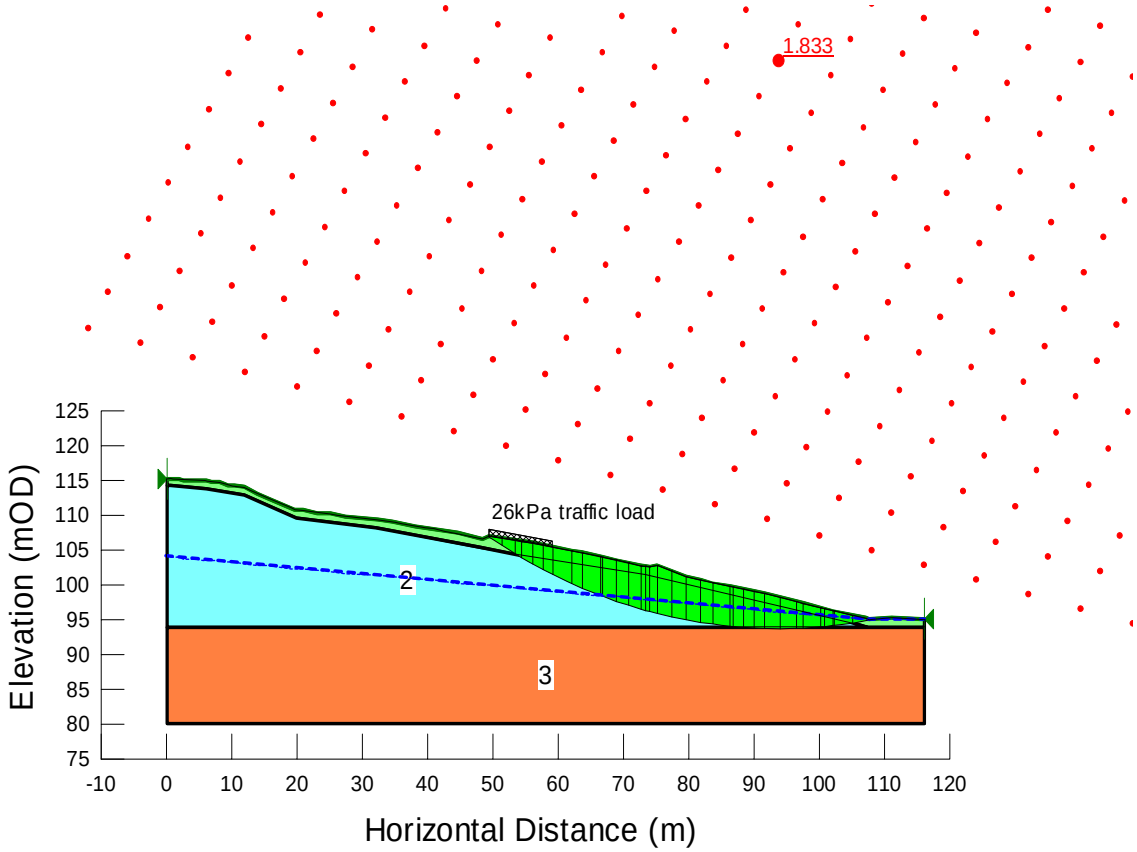
Slope name	Design Waste parameters (C, γ & φ)	Leachate Level (mAOD)	Bishop FoS	Morgenstern-Price FoS	Janbu FoS	Slip Length (m)	Slip location
A-A	0.8, 10, 17.6	95	1.30	1.30	1.20	48	Deep rotational slip through cap, waste and peat
	0.8, 10, 17.6	103	0.87	0.87	0.79	70	Deep rotational slip through cap, waste and peat
B-B	8, 11, 17.6	95	2.09	2.10	2.02	58	Deep rotational slip through cap and waste
	8, 11, 17.6	103	1.82	1.83	1.78	58	Deep rotational slip through cap and waste
C-C	8, 11, 17.6	95	1.51	1.50	1.42	20	Deep rotational slip through cap and waste
	8, 11, 17.6	103	1.16	1.19	1.07	30	Deep rotational slip through cap and waste

Figure 3.1: Typical deep rotational slope failure for Section A-A Derived waste parameters Leachate Level 95 mAOD (MP method).



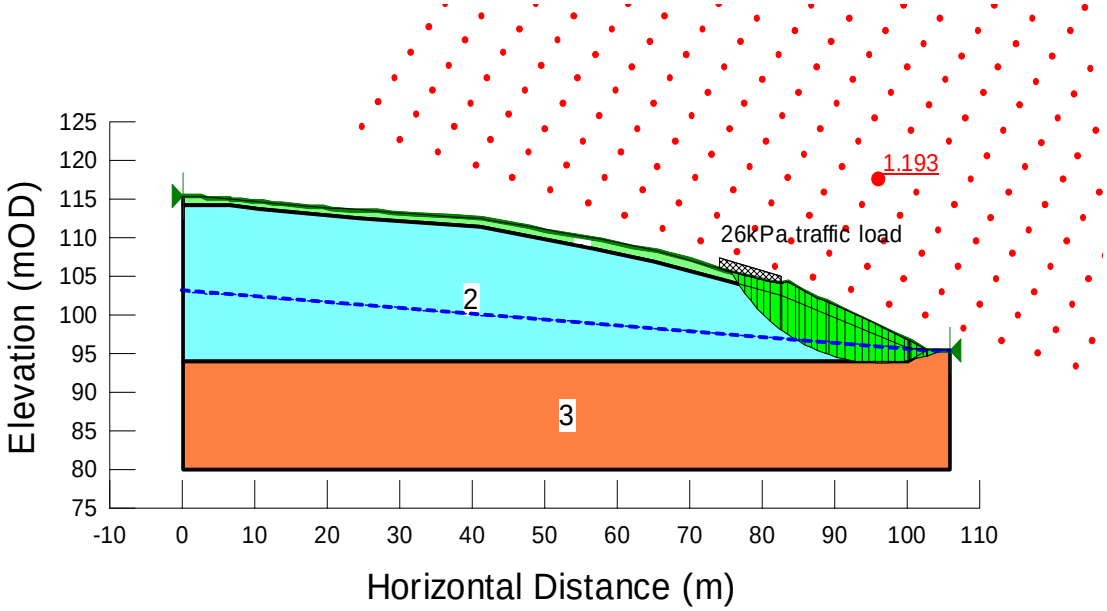
Material #: 1 Description: Temporary Capping Wt: 20 Cohesion: 3.2 Phi: 24
Material #: 2 Description: Derived Waste Wt: 10 Cohesion: 0.8 Phi: 17.6
Material #: 3 Description: Gravel drainage layer Wt: 21 Cohesion: 0 Phi: 28
Material #: 4 Description: Clay Liner Wt: 18 Cohesion: 3.2 Phi: 23.2
Material #: 5 Description: Consol. Peat Wt: 11 Cohesion: 0 Phi: 12
Material #: 6 Description: Consol. Silt Wt: 18 Cohesion: 0 Phi: 19.2
Material #: 7 Description: Sandy Gravel Wt: 21 Cohesion: 0 Phi: 28

**Figure 3.2: Typical shallow slope failure for Section B-B
Old waste parameters. Leachate Level 103 mAOD (MP method).**



Material #: 1 Description: Clay Capping Wt: 18 Cohesion: 3.2 Phi: 23.2
Material #: 2 Description: Waste (old) Wt: 10 Cohesion: 8 Phi: 17.6
Material #: 3 Description: Sand & Gravel Wt: 21 Cohesion: 0 Phi: 28

**Figure 3.3: Typical deep slope failure for Section C-C
Old waste parameters. Leachate Level 103 mAOD (MP method).**



Material #: 1 Description: Clay Capping Wt: 18 Cohesion: 3.2 Phi: 23.2
Material #: 2 Description: Waste (old) Wt: 10 Cohesion: 8 Phi: 17.6
Material #: 3 Description: Sand & Gravel Wt: 21 Cohesion: 0 Phi: 28

4 DISCUSSIONS AND CONCLUSIONS

4.1 Discussions

The factors of safety for potential slope failure along the three cross-sections modelled ranged from 0.79 to 2.05 for slope analyses undertaken using published parameters for old waste and waste parameters which were derived from the FTC back analysis of the rotational failure which occurred in 2004.

Slope A-A

Slope A-A displayed factors of safety (FoS) values ranging from 1.20 to 1.30 using the waste parameters derived by FTC following the slope failure in 2004 and typical leachate levels of 95 mAOD. By raising the leachate levels to the maximum levels recorded during 2009 (103 mAOD), the factor of safety drops to 0.79 to 0.87, which is below the recommended factor of safety of 1.0.

Slope B-B

Slope B-B displayed factors of safety (FoS) values ranging from 2.02 to 2.10 using the published parameters for old waste and typical leachate levels of 95 mAOD. Raising the leachate levels to 103 mAOD has the effect of lowering the factor of safety to 1.73 to 1.78.

Slope C-C

Slope C-C displayed factors of safety (FoS) values ranging from 1.42 to 1.51 using the published parameters for old waste and typical leachate levels of 95 mAOD. Raising the leachate levels to 103 mAOD has the effect of lowering the factor of safety to 1.07 to 1.19.

4.2 Conclusions

Based on the analyses presented, the landfill side slopes are considered stable in the long term provided that leachate levels are maintained close to the base of the waste body at levels which were typically recorded during 2009 monitoring. If leachate levels are allowed to rise to the maximum levels recorded during 2009 monitoring, the factor of safety for Slope A-A drops below the recommended factor of safety value of 1.0 and the factor of safety of Slope C-C also falls very close to the minimum required FOS of 1.0.

In order to achieve the minimum long term factors of safety required for the site, leachate levels should therefore be carefully monitored and prevented from building up within the landfill. Leachate levels should ideally be maintained below 1m above the base of the landfill to prevent instability of the landfill embankments.

Temporary stockpiling or loading of additional soils, waste or materials should not be permitted along the upper portions of the landfill, and in particular in the vicinity of Slope A-A.

It is recommended that visual monitoring of the slopes be carried out on a daily basis after heavy rainfall in order to identify any saturated zones that may develop and cause potential instability within the landfill slopes.

5 REFERENCES

1. Kolsch (1995) Material values for some mechanical properties of domestic waste, Proceedings 5th Sardinia International Landfill Symposium, Vol 2, pp 711-729.

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4. Slope Stability Reports (2007, 2008 & 2009). Donohill Landfill for Non-Hazardous Waste, Garryshane, Donohill, Co. Tipperary.

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11. Eurocode 7: Geotechnical Design. National Annex A. I.S. EN 1997-1:2004 (E). NSAI.

Appendix 1

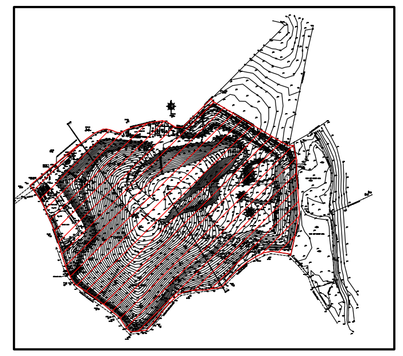
DRAWING LW10-024-01-001 Rev A:

Existing Topographic Survey showing section lines for Slope Stability Analysis

LEGEND

SLOPE STABILITY SECTIONS A — A

TOPOGRAPHICAL FOCUS SURVEY DRAWING
01-072-1 REV L UPDATED 09.10.09



KEY PLAN
Scale 1:5000

SITE PLAN
Scale 1:500

Rev.	Drawn	Origin	Auth Chk	Appd	Date	Description
A	PEL				Cork 05.03.10	ISSUE TO CLIENT
Revision History	A					

Name of Client

SOUTH TIPPERARY
COUNTY COUNCIL

Name of Job

DONOHILL LANDFILL
SLOPE STABILITY ASSESSMENT

Title of Drawing

SITE PLAN SHOWING
LINES FOR SLOPE STABILITY
ASSESSMENT

Scales Used	This Drawing was printed to
1:500	ISO A1

Dwg. No.	Rev.
LW10-024-01-001	A

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FEHILY TIMONEY & COMPANY

CONSULTANTS IN ENGINEERING & ENVIRONMENTAL SCIENCES

Core House, Pouladuff Rd, Cork, Ireland.
T:+353-21-4964133, F:+353-21-4964464

Mill House, Ashtown Gate, Navan Rd, Dublin 15, Ireland.
T:+353-1-6583500, F:+353-1-6583501

W: www.fehilytimoney.ie, E: info@ftco.ie

APPENDIX 11 VOID SPACE ANALYSIS REPORT

Louise Ryan,
Environment Department,
South Tipperary County Council,
Emmet Road,
Clonmel,
Co. Tipperary.

12th October, 2009.
Our Ref: 0-072_24

Re : Volumetric Analysis at Donohill Landfill.

Dear Louise,

Enclosed please find the results of our recent survey on the 9th October last at Donohill Landfill Site

- A plot of the updated survey with current contours only.
- A plot of the updated survey with current contours and FINAL PRE-SETTLEMENT WASTE CONTOURS (shown in green).
- A plot of the updated survey showing restoration contours. These show at a glance how much filling (if any) may take place at any area of the landfill site. Red contours indicate that the final contour level has been exceeded.

Volumetric Analysis.

A. Amount of waste/fill material gone into the Active Areas from the survey of 25-08-08 to the latest survey 09-10-09 = **14,775 m^3.**

B. Potential void space = 39,800 m^3
Amount of overfilling = 11,400 m^3
Net amount of void space = 28,400 m^3.

- *I have reduced the final pre-settlement capping contours by 1m (allowing for 1m of capping material) to approximate pre-settlement waste contours.*

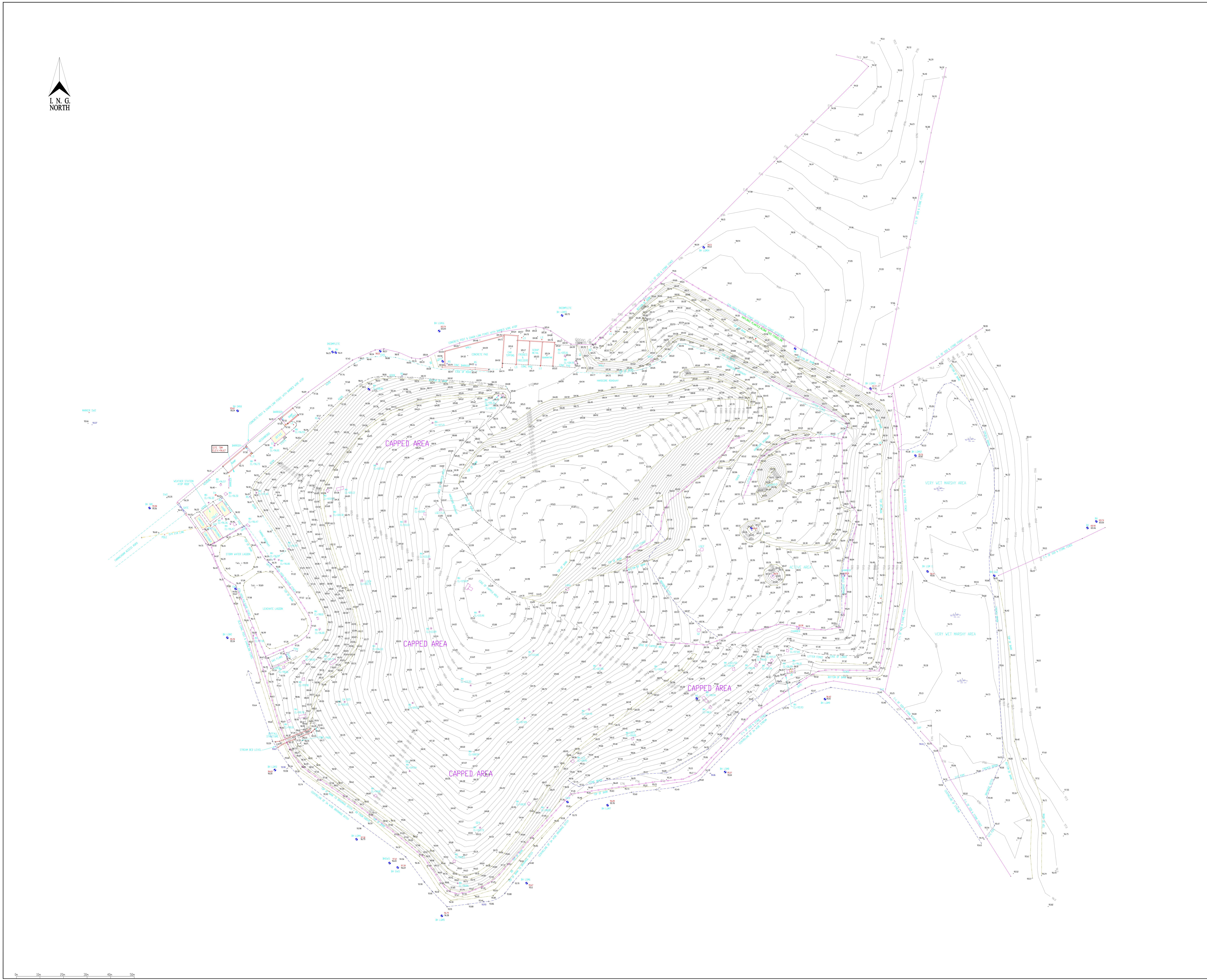
I have emailed the results to you also.

Should you have any queries, please do not hesitate to contact me.

Regards,

_____

Edgar Delaney BE MIEI MIS.



NOTES:

1. ALL LEVELS ARE IN METRES, UNLESS OTHERWISE STATED.
2. ANY DISCREPANCIES FOUND SHOULD BE REPORTED TO FOCUS SURVEYS LTD AND ANY OTHER RELEVANT PARTIES.
3. THE COORDINATE SYSTEM IS BASED ON THE IRISH NATIONAL GRID.
4. ALL LEVELS ARE RELATED TO A SITE TBM WHICH IS A HILTI-NAIL WITH ORANGE TAPE SET OFF THE SOUTH RAMP OF THE WEIGHBRIDGE ITS ELEVATION BEING 96.67m MALIN HEAD DATUM AS SHOWN ON THIS DRAWING.
5. ALL LEVELS IN RED ARE TO THE TOP OF THE BOREHOLE CASING.
6. ALL LEVELS IN BLUE ARE TO THE STREAM WATER LEVEL.
7. PIPELINES NOT VISIBLE DURING THE SURVEY MAY EXIST IN THE LONG GRASS.

LEGEND:

MH DENOTES MANHOLE
CL DENOTES MANHOLE COVER LEVEL
RG DENOTES ROAD GULLY
DLT DENOTES DRIPLINE OF TREES
LS DENOTES LAMP STANDARD
FH DENOTES FIRE HYDRANT
O/H DENOTES OVERHEAD
CP DENOTES CONTROL POINT
GT DENOTES GULLY TRAP
VP DENOTES VENT PIPE
DENOTES BOREHOLE
TOC DENOTES TOP OF CHAMBER

REVISION	REVISION DATE	DESCRIPTION OF REVISION
L	09-10-09	SURVEY UPDATE OF ACTIVE & CAPPED AREAS
K	28-08-08	SURVEY UPDATE OF ACTIVE & NON-CAPPED AREAS
J	09-10-07	SURVEY UPDATE OF ACTIVE AREA & NEW ACCESS ROAD TO CELL
H	30-01-07	SURVEY UPDATE OF ACTIVE AREA & CAPPED AREA
G	27-09-06	SURVEY UPDATE OF ACTIVE AREA & NEW CELL
F	15-02-06	VOLUMETRIC ANALYSIS ONLY
E	11-10-05	ANNUAL SURVEY UPDATE
D	11-11-04	ANNUAL SURVEY UPDATE
C	29-10-03	SURVEY UPDATE AND BOREHOLES IN ADJACENT LANDS
B	21-11-02	SURVEY UPDATE AND EXTENSION TO NORTH AND EAST
A	28-09-01	MAJOR SURVEY UPDATE

FOCUS

Focus Surveys Ltd., O'Connell Avenue, Turner's Cross, Cork.
Tel : 021-4314555 Fax : 021-4975907 e-mail : focussurveys@eircom.net

THE IRISH INSTITUTION OF SURVEYORS
#230

TITLE
TOPOGRAPHICAL SITE SURVEY

SURVEY LOCATION
**DONOHILL LANDFILL SITE,
DONOHILL, Co. TIPPERARY.**

CLIENT
SOUTH TIPPERARY COUNTY COUNCIL.

SCALE	1:500
SURVEYED BY	E.D.
DATE OF ORIGINAL SURVEY	JUNE 1998
FIRST FOCUS REVISION	27-09-01
DRAWN BY	E.D.
CHECKED BY	D.C.

DRAWING NAME: 01-072_1
REV. L

APPENDIX 12 INTEGRITY TEST OF WASTE PAINT BUND

CHEMSTORE ENVIRONMENTAL
Design and Manufacture of Environmental Safety Solutions

Clondrinagh Ind. Estate,
Ennis Road, Limerick
Republic of Ireland.
Tel: 061-327792
Fax: 061-327985
Web: www.chemstore.ie
Email: sales@chemstore.ie

Bund Test Certificate

Company:	South Tipperary Co. Council
Site:	Donohill, Co. Tipperary
Bund Reference No:	10942
Model Code:	8 drum Workfloor
Bund Dimensions:	2540L x 1350W x 150H mm
New Bund:	YES

Hydrostatic Test Results

Bunds Materials of Construction: Plastic

Bund Lining:	N/A	
Total Bund Volume:	300 L	
Bund Capacity Tested:	300 L	
110% of Vol. of Largest Vessel:	330 L	
25% of Total Storage Volume:	1200 L	
Date of Test:	27/08/2009	**Pass:** YES
Re-Test Date:	28/09/2012	

Comments/Recommendations: _____

Readings	Time	Level (mm)
1.	8:25 AM	150
2.	15:25 PM	150

Signed:	**Date:** 27/08/2009

Company Signature:

In Accordance with Chapter 6 of Environmental Protection Agency IPPC Guidance Note, June 2004

Please Store Bund Test Certificate in a Safe Place. Copies of the Certificates are charged at €45 each

APPENDIX 13 INCIDENT REPORTS

Donohill Landfill

Waste Licence Reference N°: W0074-02

Incident Report Form Date: 12 January 2009

# of Sheets including This one **ID #** 29

Date of occurrence 12/01/2009 **Time**

Place of occurrence Donohill Landfill L5 leachate well

Nature of incident (including Licence Condition affected) Leachate level trigger of 1m exceeded. Level of leachate is 1.2m

Cause of incident There was heavy rain over the weekend.

Dipping the well in the dip tube shows that the well is dry. The level of the transducer and the dip tube need to be checked to make sure that they are correctly positioned.

Emissions arising from incident None

Person Responsible for Dealing with Incident Louise Ryan

Actions used to minimise effect of incident Leachate is being pumped out of this well and tankered offsite.

Provisions taken to avoid recurrence of incident Response engineering have been asked to check that the level of the dip tube and level transducer in this well are correct.

Notifiable to Fisheries Board

Training/retraining required

Sign off (action carried out)

Signed off by Louise Ryan **Date signed off**

Signed: Louise Ryan Date : 12-01-09

Report Generated By: Louise Ryan 12 January 2009

Donohill Landfill

Waste Licence Reference N°: W0074-02

Incident Report Form Date: 02 February 2009

# of Sheets including This one	**ID #** 30
Date of occurrence 02/02/2009	**Time**
Place of occurrence LE7	
Nature of incident (including Licence Condition affected)	The level of leachate at LE7 is in exceedance of its trigger level. (2m vs. 1m)
Cause of incident	Heavy rainfall.
Emissions arising from incident	exceedance of trigger level
Person Responsible for Dealing with Incident	Louise Ryan
Actions used to minimise effect of incident	Tankering leachate offsite.
Provisions taken to avoid recurrence of incident	Capping is planned for later this year.
Notifiable to Fisheries Board	
Training/retraining required	
Sign off (action carried out)	
Signed off by Louise Ryan	**Date signed off**

Signed: _____ Date : 02-02-09

Report Generated By: Louise Ryan 02 February 2009

Donohill Landfill

Waste Licence Reference N°: W0074-02

Incident Report Form Date: 03 March 2009

# of Sheets including This one	**ID #** 31
Date of occurrence 27/02/2009	**Time** 15:50
Place of occurrence	GM12
Nature of incident (including Licence Condition affected)	Exceedance of tigger levels at this gas migration monitoring well. CH4: 1.5% (trigger: 1%) CO2: 2.3% (trigger: 1.5%) No landfill gas was detected at the other migration wells.
Cause of incident	insufficient gas extraction onsite
Emissions arising from incident	
Person Responsible for Dealing with Incident	Louise Ryan
Actions used to minimise effect of incident	
Provisions taken to avoid recurrence of incident	Additional gas wells will be drilled later trhis year as part of the capping project.
Notifiable to Fisheries Board	
Training/retraining required	
Sign off (action carried out)	
Signed off by Louise Ryan	**Date signed off**

Signed: Louise Ryan Date : 03-03-09

Report Generated By: Louise Ryan 03 March 2009

Donohill Landfill

Waste Licence Reference N°: W0074-02

Incident Report Form Date: 30 April 2009

# of Sheets including This one	1	**ID #**	**32**

Date of occurrence 30/04/2009 **Time** 8.30 - 13.30

Place of occurrence Flare

Nature of incident (including Licence Condition affected) The flare turned off at 9pm on 29-04-09 as normal. The flare would not restart on the morning of 30-04-09. It was suspected that the UV sensor was not working properly as the scada showed that the pilot light was not lighting but by looking through the viewing port on the flare it could be seen that the pilot light was lit. A call was logged with AFS.

Cause of incident Water on lens of UV sensor following heavy rainfall while the flare was turned off overnight.

Emissions arising from incident Flare not running. No gas extraction from 9pm on 29-04-09 to 1:30pm on 30-04-09, a total of 16.5 hours.

(It is routine for there to be no extraction at night. The flare is usually restarted at 08:30am so there were 5hours effective down time)

Person Responsible for Dealing with Incident Louise Ryan

Actions used to minimise effect of incident Call logged with AFS to report the problem. Service Technician from AFS returned the call and talked Louise Ryan through the procedure for removing the UV sensor and drying it. The flare then restarted. .

Provisions taken to avoid recurrence of incident Regular maintenance is carried out on this part. The procedure for drying this part is now known to the site staff. If the problem persists the part will be replaced by AFS.

Notifiable to Fisheries Board

Training/retraining required

Sign off (action carried out) Louise Ryan

Signed off by Louise Ryan **Date signed off** 30/04/2009

Signed: Louise Ryan Date : 30-04-09.

Report Generated By: Louise Ryan 30 April 2009

Donohill Landfill

Waste Licence Reference N°: W0074-02

Incident Report Form Date: 26 June 2009

# of Sheets including This one 2 **ID #** 33

Date of occurrence 17/06/2009 **Time** See below

Place of occurrence Leachate wells LGE8 and LE7

Nature of incident (including Licence Condition affected)

Leachate wells LGE8 and LE7 both have trigger levels of 1m of leachate above the cell liner.

At approx 04:30 this morning the level of leachate in LGE8 exceeded 1m. The level of leachate in this well is currently 1.57m.

The level of leachate in well LE7 reached 1.02m at approximately 12:00 today.

Cause of incident

There was very heavy rainfall in the last few days. 34.4mm of precipitation fell in the four days June 13th - 16th.

Also, there was less than the usual amount of leachate tankered offsite on Monday 15th June and Tuesday 16th June as the truck was delayed both mornings and there are works being carried out on the inlet at Tipperary WWTP which meant that leachate was taken to Cashel WWTP on Monday and one load had to go to Clonmel WWTP on Tuesday.

All three WWTPs which we use (Tipperary, Cashel and Clonmel) are all currently closed to us as their storm water tanks are full following the rain last night. So, no leachate has been tankered offsite yet today and all the leachate pumps are turned off as the lagoon is full.

Emissions arising from incident

No emissions arising from this incident.

The exceedance of trigger levels does not indicate that emissions occurred, but that actions must be taken to reduce levels below the trigger.

Person Responsible for Dealing with Incident Louise Ryan

Actions used to minimise effect of incident

The levels in the storm tank at Cashel WWTP may have reduced sufficiently to allow tankering to commence this afternoon. Once the level in the leachate lagoon drops, the pumps in the wells will be allowed to turn on and pump down the leachate in the cells.

Tankering of leachate offsite occurs on a continuous

Signed: [signature] Date : 26-06-09

Report Generated By: Louise Ryan

26 June 2009

Donohill Landfill

Waste Licence Reference N°: W0074-02

Incident Report Form Date: 26 June 2009

# of Sheets including This one 2 **ID #** 33

	basis (where allowed by WWTPs) with the objective of maintaining leachate levels at the lowest possible levels to allow for spare storage capacity when heavy rain does occur. The weather forecast is predicting reasonably dry weather for the rest of the week and into the weekend. As of 26-06-09 the level of leachate in LE7 is 0.52m and the level of leachate in LGE8 is 0.61m.
Provisions taken to avoid recurrence of incident	An SEW has been verbally approved by the EPA for capping of a portion of the site, this will reduce the amount of leachate produced onsite. We are currently awaiting confirmation that the funding is available before going to tender for this project.

Notifiable to Fisheries Board

Training/retraining required n/a

Sign off (action carried out) Louise Ryan

Signed off by Louise Ryan **Date signed off** 26/06/2009

Signed: Louise Ryan Date : 26/06/09

Report Generated By: Louise Ryan 26 June 2009

Donohill Landfill

Waste Licence Reference N°: W0074-02

Incident Report Form Date: 22 July 2009

# of Sheets including This one 2 **ID #** 34

Date of occurrence	07/07/2009	**Time**	16:00
Place of occurrence	LE7 & LGE7		

Nature of incident (including Licence Condition affected)

Leachate well LE7 has a trigger level of 1m of leachate above the cell liner.

Leachate well LGE7 which is located in the unlined part of the landfill has a leachate trigger level of 3.6m.

Works were carried out onsite all day on 07/07/2009 to extend the leachate wells in Area 4 and for this reason the power was turned off to all leachate pumping and monitoring systems all day. When power was restored yesterday evening it was noted that LE7 and LGE7 had exceeded their trigger levels. LE7 was at 1.4m of leachate and LGE7 was at 7.4m of leachate.

Cause of incident

There was very heavy rainfall on Monday 06/07/09, 31mm of rain fell on this day. Because of this rainfall all of the WWTPs closed early which caused the lecahate tankering to stop in the early afternoon.

Tipperary WWTP remained closed on 07/07/09 and leachate had to be taken to Cashel WWTP which is further away.

Added to this all leachate pumping systems were switched off on 07/07/09 to allow for works to take place, as outlined above.

Emissions arising from incident

No emissions arising from this incident.

The exceedance of trigger levels does not indicate that emissions occurred, but that actions must be taken to reduce levels below the trigger.

Person Responsible for Dealing with Incident Louise Ryan

Actions used to minimise effect of incident

Tankering of leachate to Tipperary WWTP resumed this morning (08/07/09).

All leachate pumping systems are again operational.

The level of leachate in LE7 has dropped to 1.2m since this morning and LGE7 has dropped to 4.5m since this

Signed: Louise Ryan Date : 22-07-09

Report Generated By: Louise Ryan

22 July 2009

Donohill Landfill

Waste Licence Reference N°: W0074-02

Incident Report Form Date: 22 July 2009

# of Sheets including This one 2 **ID #** 34

	morning. It is expected that the levels will continue to drop during the day. Tankering of leachate will continue during the day and the rest of the week. The weather forcast is predicting reasonably dry weather for the rest of the week with little rain expected until the weekend.
Provisions taken to avoid recurrence of incident	Update 22/07/09: Levels of leachate in LE7 & LGE7 are below the trigger levels for the past 24hrs. A long term solution is required for leachate management including capping area 1, investigation into surface water diversion & increased leachate storage.

Notifiable to Fisheries Board

Training/retraining required n/a

Sign off (action carried out) Louise Ryan

Signed off by Louise Ryan **Date signed off** 22/07/2009

Signed: Louise Ryan Date : 22-7-09

Report Generated By: Louise Ryan 22 July 2009

Donohill Landfill

Waste Licence Reference N°: W0074-02

Incident Report Form Date: 11 September 2009

# of Sheets including This one 2 **ID #** 35

Date of occurrence 31/08/2009 **Time**

Place of occurrence Leachate well LE7

Nature of incident (including Licence Condition affected) Leachate well LE7 has a trigger level of 1m of leachate above the cell liner. The current level of leachate in this cell is 1.37m.

The level of leachate was under 1m for more than 24hrs on 11-09-09.

Cause of incident Heavy rainfall during the last week, notably 11.4mm fell on 25-08-09 and 15.8mm fell on 28-08-09. There was no tankering during the weekend and the leachate level rose, filling the leachate lagoon, which switched off the pumps..

Emissions arising from incident No emissions arising from this incident.

The exceedance of trigger levels dows not indicate that emissions occurred, but that actions must be taken to reduce levels below the trigger. Level of leachate

Person Responsible for Dealing with Incident Louise Ryan

Actions used to minimise effect of incident

Tankering of leachate to Tipperary WWTP resumed this morning. It is expected that the level of leachate in the lagoon will be low enough to allow pumping to resume before the end of the day.
In addition to the usual tanker, an extra tanker has been booked for two days this week to assist in removing leachate offsite.

A meeting took place on 18-08-09 between South Tipperary County Council and Earthtech (operators of WWTPs) where Earthtech gave an undertaking that they would carry out the necessary modifications to the empty storage tank in CashelWWTP for use for leachate storage.

Earthtech requested further information from STCC to allow them to finalise the design for the tank. This further information was provided to Earthtech by STCC on 27-08-09.

Signed: Louise Ryan Date : 11 September 2009

Report Generated By: Louise Ryan

Donohill Landfill

Waste Licence Reference N°: W0074-02

Incident Report Form Date: 11 September 2009

# of Sheets including This one	2 **ID #** 35
	STCC now await Earthtech to respond with a design proposal for the tank.
Provisions taken to avoid recurrence of incident	The tender documents for the next capping phase onsite have been prepared by Fehily Timoney Consultants. STCC is currently finalising these documents before proceeding to tender.
Notifiable to Fisheries Board	
Training/retraining required	
Sign off (action carried out)	Louise Ryan
Signed off by	Louise Ryan **Date signed off** 11/09/2009

Signed: Louise Ryan Date : 11/09/09

Report Generated By: Louise Ryan 11 September 2009

Donohill Landfill

Waste Licence Reference N°: W0074-02

Incident Report Form Date: 11 September 2009

# of Sheets including This one **ID #** 36

Date of occurrence 04/09/2009 **Time**

Place of occurrence Leachate wells LGE8 & LGE7

Nature of incident (including Licence Condition affected) Following heavy rainfall all this week and despite tankering leachate offsite everyday the leachate levels have risen above trigger levels in a further two wells:

LGE8: Leachate level of 1.3m this morning (trigger level is 1.0m) Current level of leachate is 0.61m but this is expected to rise again once the pump turns off over the weekend.

LGE7: 7.5m of leachate this morning (trigger level is 3.6m). Current level of leachate is 2.1m, but this is expected to rise again when the pump turns off over the weekend.

The level of leachate in LE7 was 1.3m this morning as reported in incident # 35. (trigger level 1m). The current level of leachate in this well is 0.6m, but this is expected to rise again over the weekend once the pumps turn off.

The level of leachate was below 1m at LGE8 for over 24hrs on 11-09-09. The level of lecahate in LGE7 has also dropped below its trigger level, on this date although it is still fluctauting slightly.

Cause of incident Heavy rainfall for the past week.

Despite tankering of leachate offsite took place every day this week, including the use of a second truck to help remove leachate for three days this week, the level of leachate has exceeded the triggers.

Emissions arising from incident No emissions arising from this incident.

The exceedance of trigger levels does not indicate that emissions occurred, but that actions must be taken to reduce levels below the trigger.

Person Responsible for Dealing with Incident Louise Ryan

Actions used to minimise effect of incident The second leachate truck has been booked for three days next week, in addition to the usual truck which will be onsite for 5 days next week.

Signed: Louise Ryan Date : 11-09-09

Report Generated By: Louise Ryan 11 September 2009

Donohill Landfill

Waste Licence Reference N°: W0074-02

Incident Report Form Date: 11 September 2009

# of Sheets including This one 2 **ID #** 36

	Continued tankering of leachate offsite will reduce the levels of lecahate and bring them back below the trigger levels.
Provisions taken to avoid recurrence of incident	The tender documents for the next capping phase onsite have been prepared by Fehily Timoney Consultants. STCC is currently finalising these documents before proceeding to tender.
Notifiable to Fisheries Board	
Training/retraining required	
Sign off (action carried out)	Louise Ryan
Signed off by	Louise Ryan
Date signed off	11/09/2009

Signed: Date : 11 - 09 - 09

Report Generated By: Louise Ryan 11 September 2009

Donohill Landfill

Waste Licence Reference N°: W0074-02

Incident Report Form Date: 03 March 2010

# of Sheets including This one 5 **ID #** 37

Date of occurrence 07/10/2009 **Time**

Place of occurrence LE7 & LGE7 & LGE8

Nature of incident (including Licence Condition affected)

Leachate well LE7, LGE8 and LGE7 have exceeded their trigger levels for height of leachate.

The heavy rainfall that occurred during the rest of October and into November resulted in the levels of leachate remaining above their trigger levels. Further snow and rain in January have raised leachate levels again.

The pump in LGE7 has been repaired and is now operational. The pump in LGE8 was removed for repair today.

The leachate level is currently as follows:

LGE7: 7.35m(trigger 3.6m) due to lagoon full and pump off
LE7: 1.36m (trigger 1m) due to lagoon full and pump off

LGE8 and LE6 are showing incorrect values on the SCADA system, a new resistor has been ordered for the panel to correct the fault. The reading in question are as follows:
LGE8 reading 0.02m on SCADA. This is incorrect and there is over 1.5m of leachate in this well.
LE6: 9.06m: This is incorrect, there is less than 1m of leachate in this well, this well is in a capped part of the site and the well is only 5.9m deep.

There was no leachate tankered offsite on Monday January 11th due to heavy snowfall making roads dangerous to travel on. Leachate tankering resumed today to Cashel WWTP. Additional tankers have been ordered from tomorrow to make up for Monday 11th.

Cause of incident Heavy precipitation since October 2009 have caused the leachate levels to be consistently exceeding the trigger level at one or more of the listed wells.
A record of the leachate levels over this time period is attached for your information. Leachate levels are now below trigger elvels across th site.

Emissions arising from incident No emission arising from this incident.

Signed: Louise Ryan Date : 03-03-10

Report Generated By: Louise Ryan 03 March 2010

Donohill Landfill

Waste Licence Reference N°: W0074-02

Incident Report Form Date: 03 March 2010

# of Sheets including This one | **ID #** 37

The exceedance of trigger levels does not indicate that emissions occurred, but that actions must be taken to reduce levels below the trigger.

Person Responsible for Dealing with Incident Louise Ryan

Actions used to minimise effect of incident Leachate tankered offsite until levels reduce.

Provisions taken to avoid recurrence of incident A precedent has now been set for use of the storage tank in Cashel WWTP and it will be available for us to use in the future.

The tender process for the next capping phase is due to begin in early 2010, with a contractor to be appointed thereafter.

Notifiable to Fisheries Board ☐

Training/retraining required

Sign off (action carried out) Louise Ryan

Signed off by Louise Ryan **Date signed off** 03/03/2010

Signed: Louise Ryan Date : 03-03-10

Report Generated By: Louise Ryan 03 March 2010

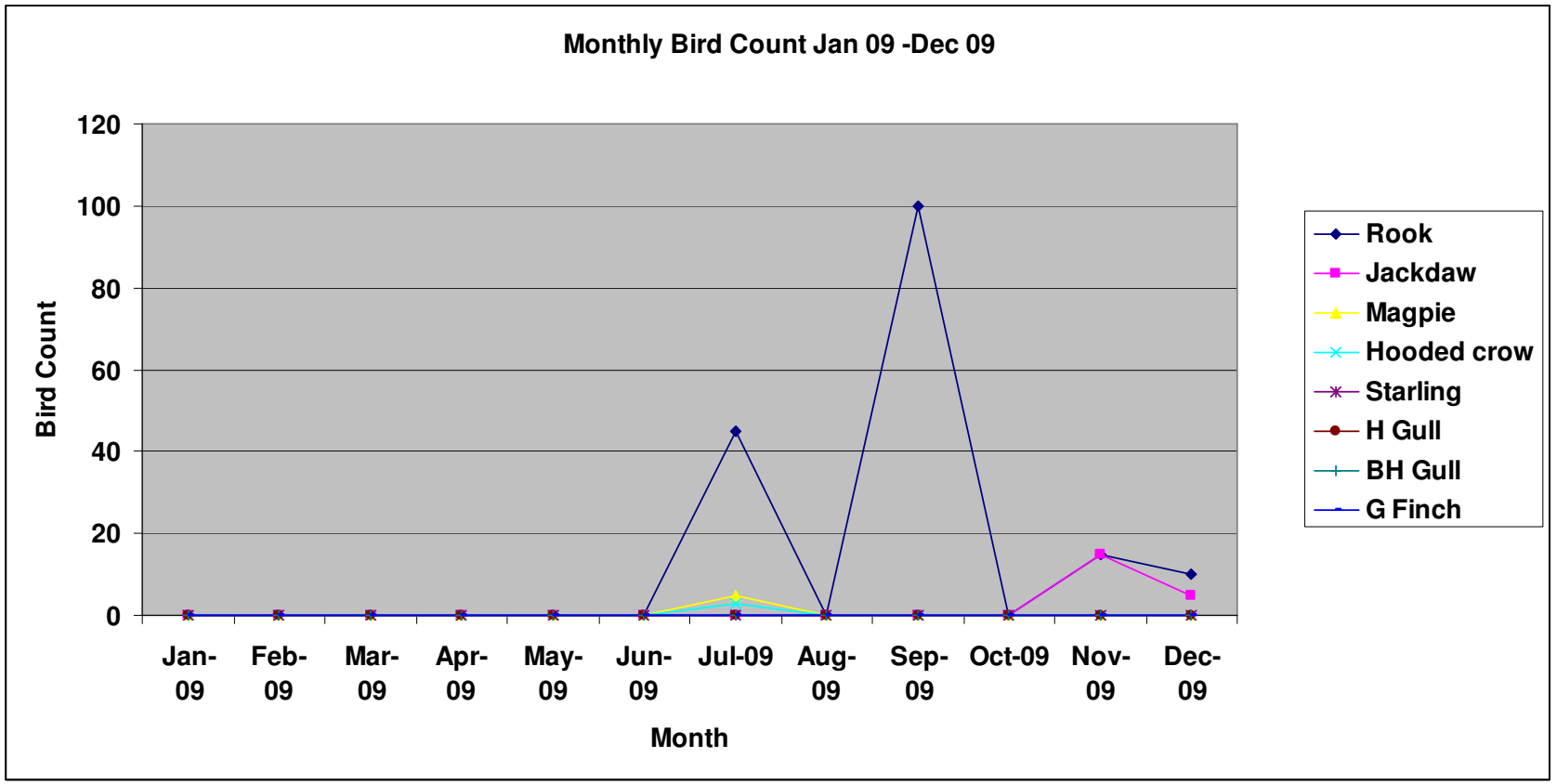
Date & Time	LE8 level(m) Sump >4m deep	LE7 level(m) Area 4 Trigger: 1m	LE6 level(m) Area 1 Readings of 9m due to system fault	LGE6 level(m) Area 1 No trigger	LGE8 level(m) Area 3 Trigger: 1m	LGE7 level(m) Area 1 Trigger: 3.6m	LC4 level(m) Leachate lagoon Full at 1m
01/10/2009 23:30	1.245	0.694	0.078	2.163	0.169	0.390	0.905
02/10/2009 23:30	1.488	0.693	0.078	2.229	0.108	**4.900**	0.644
03/10/2009 23:30	1.298	0.687	0.078	2.309	0.094	**6.402**	0.727
04/10/2009 23:30	1.234	0.682	0.079	2.296	0.072	**6.725**	0.759
05/10/2009 23:30	1.323	0.708	0.079	2.308	0.070	**6.612**	0.527
06/10/2009 23:30	1.921	**1.202**	0.246	2.785	**1.055**	**6.128**	0.979
07/10/2009 23:30	1.902	**1.131**	0.301	2.527	0.011	**6.841**	1.028
08/10/2009 23:30	1.715	**1.103**	0.300	2.130	0.793	**6.226**	0.991
09/10/2009 23:30	1.851	**1.197**	0.310	2.777	0.945	**7.373**	1.006
10/10/2009 23:30	2.111	**1.283**	0.315	2.753	0.991	**7.406**	1.003
11/10/2009 23:30	2.439	**1.422**	0.316	2.866	**1.118**	**7.525**	1.011
12/10/2009 23:30	2.660	**1.271**	0.313	2.226	0.973	**6.926**	1.013
13/10/2009 23:30	2.111	**1.100**	0.302	1.495	0.871	**6.146**	1.082
14/10/2009 23:30	1.707	**1.091**	0.313	2.161	0.895	**7.083**	0.983
15/10/2009 23:30	1.238	**1.092**	0.310	2.299	0.811	**7.152**	0.917
16/10/2009 23:30	1.022	**1.110**	0.081	1.894	0.718	**6.433**	0.847
17/10/2009 23:30	1.390	**1.145**	0.081	2.236	0.702	**7.072**	0.888
18/10/2009 23:30	1.217	**1.181**	0.285	2.391	0.737	**7.222**	0.982
19/10/2009 23:30	1.233	**1.219**	0.079	1.506	0.655	**6.742**	0.857
20/10/2009 23:30	1.115	**1.250**	0.081	2.435	0.689	**6.900**	0.762
21/10/2009 23:30	2.044	**1.250**	0.325	2.947	**1.040**	**7.789**	0.907
22/10/2009 23:30	2.180	**1.250**	0.312	2.168	**1.003**	**6.938**	1.000
23/10/2009 23:30	2.454	**1.293**	0.321	2.631	0.990	**7.442**	0.982
24/10/2009 23:30	3.272	**1.540**	0.330	2.968	**1.250**	**7.819**	0.995
25/10/2009 23:30	3.271	**1.627**	0.329	2.825	**1.318**	**7.640**	0.995
26/10/2009 23:30	3.274	**1.667**	0.337	2.820	**1.359**	**7.588**	0.998
27/10/2009 23:30	2.885	**1.199**	0.331	2.585	**1.259**	**7.153**	0.977
28/10/2009 23:30	2.781	**1.196**	0.336	2.728	**1.108**	**7.541**	0.940
29/10/2009 23:30	1.721	**1.148**	0.326	1.959	0.974	**6.996**	0.979
30/10/2009 23:30	2.372	**1.329**	0.343	2.833	**1.144**	**7.839**	1.007
31/10/2009 23:30	3.137	**1.482**	0.347	2.918	**1.295**	**7.865**	1.010
01/11/2009 23:30	3.608	**2.267**	0.370	3.236	**2.997**	**8.051**	1.054
02/11/2009 23:30	3.559	**2.280**	0.368	3.195	**3.181**	**7.958**	0.983
03/11/2009 23:30	3.577	**2.232**	0.374	3.051	**3.603**	**7.709**	0.925
04/11/2009 23:30	3.593	**2.299**	0.349	2.727	**3.988**	**7.478**	0.972
05/11/2009 23:30	3.546	**1.833**	0.324	2.098	**3.604**	**6.878**	0.978
06/11/2009 23:30	3.567	**1.745**	0.330	2.715	**3.861**	**7.311**	0.932
07/11/2009 23:30	3.592	**2.091**	0.351	3.137	**4.518**	**7.872**	0.948
08/11/2009 23:30	3.541	**2.178**	0.340	2.947	**4.501**	**7.657**	0.943
09/11/2009 23:30	3.628	**1.947**	0.324	2.626	**4.928**	**6.994**	0.999
10/11/2009 23:30	3.586	**1.722**	0.325	2.204	**4.617**	**6.837**	0.986
11/11/2009 23:30	3.610	**1.662**	0.343	3.030	**4.814**	**7.835**	0.980
12/11/2009 23:30	3.600	**1.730**	0.340	2.810	**4.819**	**7.329**	1.002
13/11/2009 23:30	3.663	**1.369**	0.178	3.027	**5.103**	**6.973**	0.988
14/11/2009 23:30	3.615	**2.283**	0.345	3.130	**4.966**	**7.791**	1.000
15/11/2009 23:30	3.601	**2.463**	0.350	3.154	**5.051**	**7.689**	1.008
16/11/2009 23:30	3.614	**3.086**	0.366	3.269	**4.976**	**7.926**	0.987
17/11/2009 23:30	3.617	**2.126**	0.287	2.706	**4.941**	**6.475**	0.981
18/11/2009 23:30	3.624	**1.361**	0.315	2.854	**4.774**	**5.879**	0.981
19/11/2009 23:30	3.642	**2.331**	0.361	3.362	**5.056**	**8.048**	0.990
20/11/2009 23:30	3.618	**2.481**	0.337	2.954	**4.808**	**7.456**	1.004
21/11/2009 23:30	3.631	**3.196**	0.365	3.298	**5.006**	**8.036**	1.020
22/11/2009 23:30	3.631	**3.489**	0.366	3.299	**5.017**	**7.721**	1.029
23/11/2009 23:30	3.643	**3.089**	0.358	2.978	**4.994**	**7.438**	0.978
24/11/2009 23:30	3.642	**3.729**	0.371	3.305	**5.056**	**7.993**	0.996
25/11/2009 23:30	3.654	**2.471**	0.085	2.761	**4.919**	**7.236**	0.851
26/11/2009 23:30	3.679	**1.256**	0.292	2.822	**4.568**	**7.377**	0.979
27/11/2009 23:30	3.584	**1.243**	0.335	2.340	**4.570**	**6.975**	0.991
28/11/2009 23:30	3.604	**1.424**	0.347	2.864	**4.861**	**7.614**	0.990
29/11/2009 23:30	3.618	**1.684**	0.343	2.989	**4.944**	**7.576**	0.999
30/11/2009 23:30	3.412	**1.202**	0.319	1.843	**4.392**	**6.765**	0.981
01/12/2009 23:30	1.332	**1.164**	0.341	2.621	**4.148**	**7.473**	0.977
02/12/2009 23:30	1.452	0.705	0.085	2.261	**3.783**	**6.701**	0.788
03/12/2009 23:30	1.420	0.690	0.085	2.586	**3.102**	**7.218**	0.608
04/12/2009 23:30	1.359	0.688	0.086	2.946	**2.272**	**7.696**	0.706
05/12/2009 23:30	1.943	**1.330**	0.340	3.120	**3.068**	**8.036**	0.983
06/12/2009 23:30	2.319	**1.461**	0.335	3.088	**3.379**	**7.905**	0.981
07/12/2009 23:30	1.743	**1.200**	0.327	2.424	**3.135**	**6.924**	0.983
08/12/2009 23:30	1.432	0.771	0.085	2.421	**1.628**	**7.128**	0.979

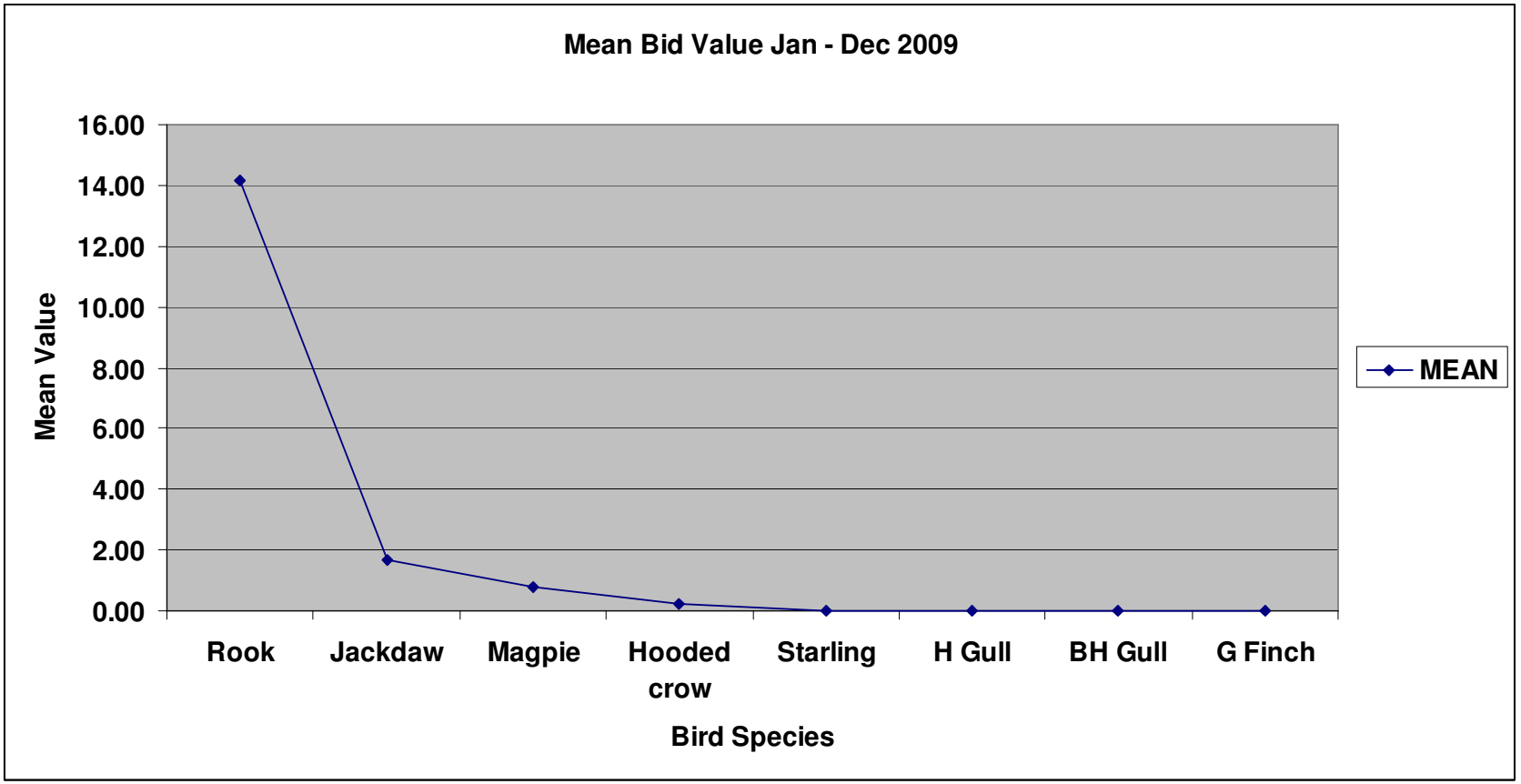
Date & Time	LE8 level(m) Sump >4m deep	LE7 level(m) Area 4 Trigger: 1m	LE6 level(m) Area 1 Readings of 9m due to system fault	LGE6 level(m) Area 1 No trigger	LGE8 level(m) Area 3 Trigger: 1m	LGE7 level(m) Area 1 Trigger: 3.6m	LC4 level(m) Leachate lagoon Full at 1m
09/12/2009 23:30	1.447	0.680	0.088	2.079	0.602	**6.301**	0.813
10/12/2009 23:30	1.003	0.688	0.090	1.742	0.015	**6.890**	0.729
11/12/2009 23:30	1.164	0.690	0.089	2.245	0.017	**6.809**	0.557
12/12/2009 23:30	1.202	0.692	0.086	2.391	0.017	**7.131**	0.769
13/12/2009 23:30	1.192	0.717	0.086	2.497	0.012	**7.322**	0.925
14/12/2009 23:30	1.154	0.688	0.082	2.580	0.557	**6.848**	0.550
15/12/2009 23:30	1.103	0.709	0.084	2.628	0.008	**6.902**	0.338
16/12/2009 23:30	0.989	0.725	0.085	2.675	0.007	**6.105**	0.496
17/12/2009 23:30	1.469	0.718	0.084	2.621	0.007	**6.005**	0.562
18/12/2009 23:30	1.376	0.668	0.082	2.588	0.007	**6.454**	0.674
19/12/2009 23:30	1.277	0.704	0.082	2.666	0.473	**7.132**	0.780
20/12/2009 23:30	1.170	0.677	0.082	2.732	0.464	**7.302**	0.881
21/12/2009 23:30	1.026	0.722	0.082	2.812	0.497	**6.369**	0.558
22/12/2009 23:30	1.453	0.730	0.082	2.792	0.499	**5.549**	0.587
23/12/2009 23:30	1.332	0.691	0.082	2.787	0.521	0.280	0.501
24/12/2009 23:30	1.178	0.670	0.082	2.736	0.514	**4.874**	0.602
25/12/2009 23:30	1.497	0.706	0.082	2.709	0.516	**6.785**	0.634
26/12/2009 23:30	1.408	0.701	0.083	2.700	0.551	**6.904**	0.736
27/12/2009 23:30	1.343	0.685	0.082	2.610	0.592	**6.862**	0.829
28/12/2009 23:30	1.211	0.679	0.083	2.646	0.574	**6.938**	0.927
29/12/2009 23:30	2.021	**1.393**	0.289	3.003	0.927	**7.092**	0.998
30/12/2009 23:30	3.340	**1.732**	0.321	3.165	**1.319**	**7.705**	0.925
31/12/2009 23:30	3.446	**1.682**	0.313	3.000	**1.445**	**7.511**	0.934
01/01/2010 23:30	2.636	**1.731**	0.309	2.935	**1.499**	**7.515**	0.931
02/01/2010 23:30	2.669	**1.757**	0.307	2.884	**1.546**	**7.395**	0.935
03/01/2010 23:30	2.659	**1.792**	0.306	2.829	**1.589**	**7.240**	0.937
04/01/2010 23:30	2.654	**1.439**	0.303	2.826	**1.636**	**7.113**	0.925
05/01/2010 23:30	2.964	**1.184**	0.303	1.864	**1.679**	**6.523**	0.908
06/01/2010 23:30	1.954	**1.155**	**9.052**	1.824	0.027	**6.107**	0.909
07/01/2010 23:30	1.373	0.707	**9.037**	2.209	0.036	**6.830**	0.841
08/01/2010 23:30	1.332	0.679	**9.028**	2.270	0.039	**6.781**	0.737
09/01/2010 23:30	1.220	0.694	**9.011**	2.349	0.036	**6.816**	0.819
10/01/2010 23:30	1.058	0.704	**9.031**	2.447	0.025	**6.866**	0.896
11/01/2010 23:30	1.495	0.690	**9.075**	1.584	0.025	**6.171**	0.912
12/01/2010 23:30	2.732	**1.534**	**9.059**	3.081	0.025	**7.609**	0.932
13/01/2010 23:30	3.525	**1.602**	**9.070**	2.831	0.024	**7.454**	0.890
14/01/2010 23:30	3.661	**1.250**	**9.065**	2.401	0.022	**6.342**	0.983
15/01/2010 23:30	3.395	**1.271**	**9.110**	2.627	0.021	**7.137**	0.992
16/01/2010 23:30	3.610	**1.578**	**9.093**	2.926	0.029	**7.792**	0.995
17/01/2010 23:30	3.541	**1.659**	**9.090**	2.859	0.026	**7.563**	0.995
18/01/2010 23:30	3.674	**1.314**	**9.096**	2.112	0.024	**6.648**	0.905
19/01/2010 23:30	2.987	**1.232**	**9.095**	2.790	0.021	**7.482**	0.903
20/01/2010 23:30	2.635	**1.224**	**9.099**	2.699	**5.040**	**7.139**	1.006
21/01/2010 23:30	3.436	**1.417**	**9.119**	2.587	**5.095**	**7.165**	0.980
22/01/2010 23:30	3.485	**1.256**	**9.090**	2.763	**4.913**	**7.515**	1.008
23/01/2010 23:30	3.531	**1.361**	**9.069**	2.801	**5.025**	**7.483**	1.004
24/01/2010 23:30	3.532	**1.473**	**9.074**	2.785	**5.043**	**7.391**	1.007
25/01/2010 23:30	2.439	**1.168**	**9.069**	2.724	**4.590**	**7.274**	0.978
26/01/2010 23:30	1.240	**1.138**	**9.082**	1.593	**3.905**	**6.788**	0.978
27/01/2010 23:30	1.374	0.701	**9.121**	1.900	**2.387**	**7.018**	0.766
28/01/2010 23:30	1.486	0.686	**9.123**	1.884	0.924	**6.250**	0.668
29/01/2010 23:30	1.072	0.705	**99999.900**	2.479	0.025	**6.482**	0.688
30/01/2010 23:30	1.145	1.132	**9.115**	2.623	0.923	**0.682**	0.978
31/01/2010 23:30	1.487	1.198	**9.073**	2.640	**1.034**	**6.922**	0.974
01/02/2010 23:30	1.303	0.708	**9.096**	1.866	0.997	**6.772**	0.912
02/02/2010 23:30	1.418	0.688	**9.129**	2.443	0.023	**7.228**	0.958
03/02/2010 23:30	1.995	**1.250**	**9.109**	1.414	**1.132**	**5.752**	0.984
04/02/2010 23:30	2.949	**1.250**	**9.101**	2.799	**1.486**	**7.969**	0.998
05/02/2010 23:30	3.818	**1.862**	**9.100**	2.121	**1.776**	**7.162**	0.990
06/02/2010 23:30	3.831	**1.937**	**9.083**	2.551	**2.008**	**7.526**	0.987
07/02/2010 23:30	3.528	**1.983**	**9.090**	2.681	**2.186**	**7.614**	0.986
08/02/2010 23:30	3.244	**1.717**	**9.084**	2.518	**1.928**	**6.865**	0.979
09/02/2010 23:30	2.022	**1.435**	**9.085**	2.556	**1.638**	**6.969**	0.977
10/02/2010 23:30	1.381	**1.403**	**9.071**	2.635	**1.376**	**7.209**	0.962
11/02/2010 23:30	1.358	0.529	**9.103**	1.608	0.023	**5.822**	0.669
12/02/2010 23:30	1.300	0.487	**9.129**	2.190	0.019	**2.074**	0.524
13/02/2010 23:30	1.197	0.480	**99999.900**	2.370	0.019	**6.973**	0.737
14/02/2010 23:30	1.046	0.472	**99999.900**	2.480	0.022	**7.239**	0.903
15/02/2010 23:30	1.529	0.470	**99999.900**	2.645	0.647	**6.637**	0.697

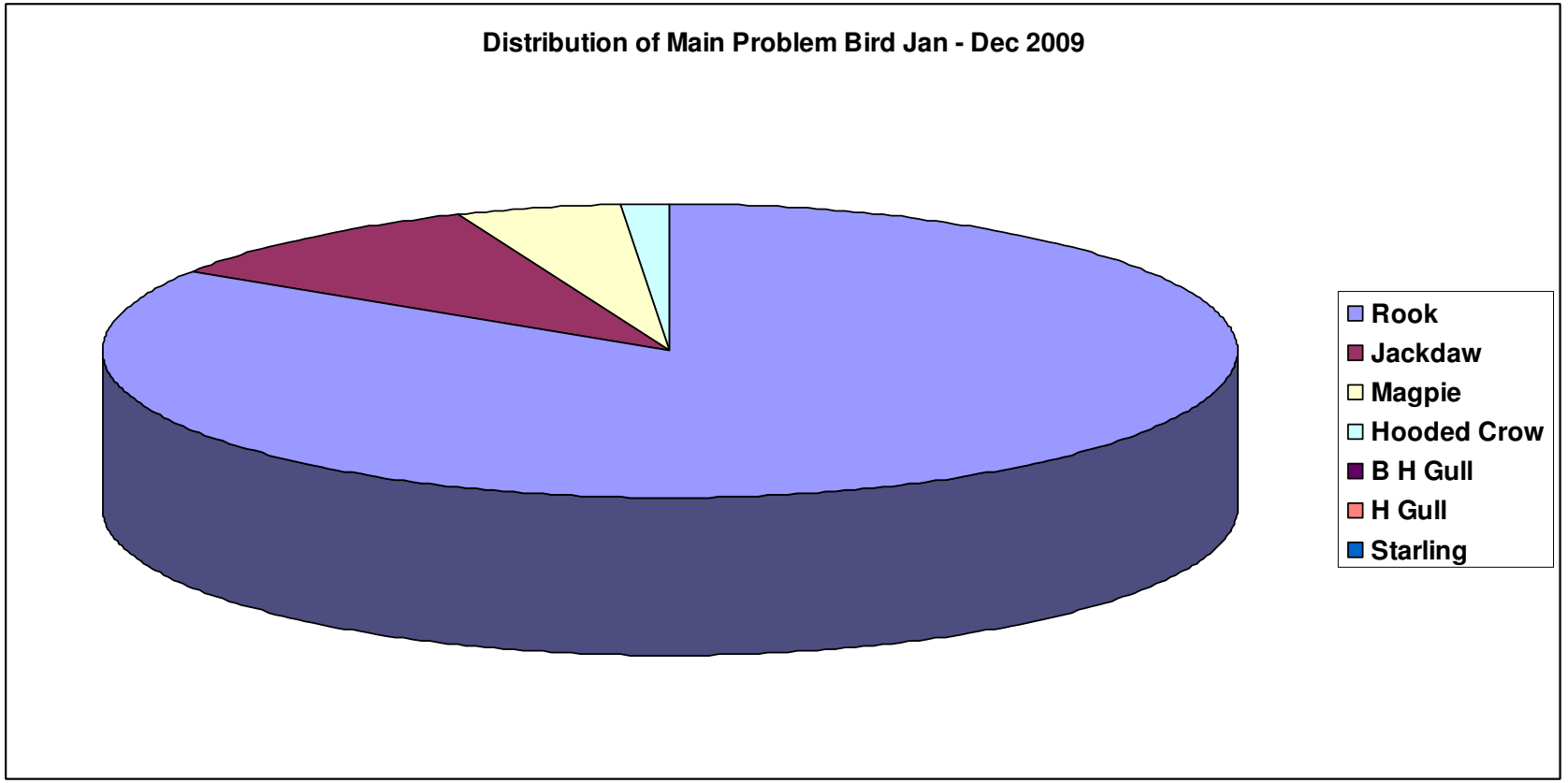
Date & Time	LE8 level(m) Sump >4m deep	LE7 level(m) Area 4 Trigger: 1m	LE6 level(m) Area 1 Readings of 9m due to system fault	LGE6 level(m) Area 1 No trigger	LGE8 level(m) Area 3 Trigger: 1m	LGE7 level(m) Area 1 Trigger: 3.6m	LC4 level(m) Leachate lagoon Full at 1m
16/02/2010 23:30	1.470	0.467	**99999.900**	2.742	0.021	**7.273**	0.546
17/02/2010 23:30	1.370	0.486	**9.127**	2.720	0.019	**7.399**	0.365
18/02/2010 23:30	1.228	0.482	**9.105**	2.671	0.615	0.064	0.145
19/02/2010 23:30	1.538	**1.359**	0.080	1.845	0.636	0.298	0.281
20/02/2010 23:30	1.321	**1.385**	0.079	2.267	0.675	0.307	0.476
21/02/2010 23:30	1.352	**1.428**	0.080	2.426	0.706	0.316	0.550
22/02/2010 23:30	1.352	**1.477**	0.079	2.482	0.729	0.339	0.664
23/02/2010 23:30	1.015	**1.500**	0.080	2.564	0.756	0.308	0.482
24/02/2010 23:30	1.216	0.698	0.080	2.554	0.619	0.312	0.646
25/02/2010 23:30	1.210	0.707	0.080	2.605	0.636	0.395	0.460
26/02/2010 23:30	1.126	0.698	0.080	2.570	0.632	0.307	0.584
27/02/2010 23:30	1.533	0.685	0.225	2.607	0.724	3.086	0.612
28/02/2010 23:30	1.414	0.683	0.294	2.544	0.751	**6.508**	0.698
01/03/2010 23:30	1.254	0.700	0.288	2.458	0.771	**6.625**	0.473
02/03/2010 23:30	1.230	0.689	0.081	1.518	0.672	0.325	0.536

APPENDIX 14 BIRD CONTROL REPORT

Year End Report for Donohill Landfill January 09 to December 09									
	Rook	**Jackdaw**	**Magpie**	**Hooded crow**	**Starling**	**H Gull**	**BH Gull**	**G Finch**	**MONTH TOTAL**
Jan-09	0	0	0	0	0	0	0	0	0
Feb-09	0	0	0	0	0	0	0	0	0
Mar-09	0	0	0	0	0	0	0	0	0
Apr-09	0	0	0	0	0	0	0	0	0
May-09	0	0	0	0	0	0	0	0	0
Jun-09	0	0	0	0	0	0	0	0	0
Jul-09	45	0	5	3	0	0	0	0	53
Aug-09	0	0	0	0	0	0	0	0	0
Sep-09	100	0	0	0	0	0	0	0	100
Oct-09	0	0	0	0	0	0	0	0	0
Nov-09	15	15	0	0	0	0	0	0	30
Dec-09	10	5	0	0	0	0	0	0	15
Total	**170**	**20**	**5**	**3**	**0**	**0**	**0**	**0**	
	Rook	**Jackdaw**	**Magpie**	**Hooded crow**	**Starling**	**H Gull**	**BH Gull**	**G Finch**	
MEAN	14.17	1.67	0.77	0.25	0.00	0.00	0.00	0.00	
STANDARD	53.61	6.85	1.95	1.17	0.00	0.00	0.00	0.00	
	2005	**2006**	**2007**	**2008**	**2009**				
Rook	44.58	26.33	8.33	24.17	14.17				
Jackdaw	0.05	0.00	0.00	0.00	1.67				
Magpie	0.00	0.00	0.00	0.00	0.77				
Hooded Crow	0.25	0.00	0.83	45.00	0.25				
B H Gull	0.00	0.00	0.00	0.00	0				
H Gull	0.00	2.50	1.67	0.00	0				
Starling	0.00	0.00	0.00	0.00	0				


Monthly Bird Count Jan 09 -Dec 09
Bird Count
120
100
80
60
40
20
0
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Month
Rook
Jackdaw
Magpie
Hooded crow
Starling
H Gull
BH Gull
G Finch


Mean Bid Value Jan - Dec 2009
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Mean Value
Rook
Jackdaw
Magpie
Hooded crow
Starling
H Gull
BH Gull
G Finch
Bird Species
MEAN


Distribution of Main Problem Bird Jan - Dec 2009
Rook
Jackdaw
Magpie
Hooded Crow
B H Gull
H Gull
Starling

Bird Control Ireland Ltd.

Littlebridge Inches, Cappoquin, Co. Waterford, Ireland

Year End Report

Client South Tipperary County Council

Location Donohill Landfill Site

Period covered January 2009 – December 2009

Bird Control Ireland Ltd operated a bird control programme at Donohill Landfill between January 2009 and December 2009.

During each visit to the site a *Visit Log* was completed giving details of activities for the period of time on site and also giving recommendations to the site staff. These sheets are then compiled and a *Month End Report* was submitted to Donohill Landfill (South Tipperary County Council) and put into bird control manual.

The objective of this project was to prevent scavenging birds from gathering on site.
Throughout the year all possible bird control measures were utilized to remind birds attempting to raid that Donohill landfill is not a safe location for them.

Throughout the year the following activities on site were undertaken:

- Flying birds of prey and use of pyrotechnics
- Various types of kites were flown.
- Visiting site at various times to prevent birds scavenging.
- Liaison with site management involved reviewing bird control programme and results. Monthly bird survey and report.
- Using variation of bird control methods to achieve nest results.
-

8 out of 12 months on site no birds were recorded. This is an excellent level of bird control. A group of corvids on site in September were noted during a period of inclement weather conditions. Every bird control measure was put in place to push birds off site.
In July a large number of mixed corvids were on site at time of arrival. At this time of year, juvenile birds have fledged the nest in order to look for food and survive and so it is very likely that bird pressure during this time will increase on site.

Tel: 00 353 58 52302 Fax: 00 353 58 52892 e-mail: bci@eircom.net
Directors: Jeremy Nicholson, Orla Nicholson - Co. Reg.: 322127

Bird Control Ireland Ltd.

Littlebridge Inches, Cappoquin, Co. Waterford, Ireland

Site staff were responsible for the daily deployment of visual deterrents and for using distress calls on a daily basis.

Jackdaws and Rooks are the main pest bird at Donohill, they will raid if deterrents are not deployed.

The programme harassed the most persistent birds and they were not permitted to scavenge.

The staff at Donohill deployed equipment daily, unless inclement weather conditions such as high winds or heavy rain prevented them from doing so.

Bird Control Ireland Ltd are satisfied that a very good level of bird control has been established and maintained at Donohill and the company will revue the programme with council Management and landfill staff and management during 2010 to ensure continued success.

Jeremy Nicholson
Managing Director

Tel: 00 353 58 52302 Fax: 00 353 58 52892 e-mail: bci@eircom.net
Directors: Jeremy Nicholson, Orla Nicholson - Co. Reg.: 322127

APPENDIX 15 LEACHATE LEVELS

	2009												
Date & Time		B.LE8 leve	B.LE7 leve	B.LE9 leve	B.LE10 lev	B.LE11 lev	B.LE6 leve	B.LGE6 lev	B.LGE8 lev	B.LGE7 lev	B.LE4 leve	B.LE2 leve	B.LC4 leve
01/01/2009	23:30	1.551181	0.706438	0.23347	-0.093351	0.041865	0.259316	2.118568	0.291683	0.892961	1.562228	0.640066	0.77677
02/01/2009	23:30	1.237505	0.659506	0.232089	-0.090675	0.033764	0.051255	1.949443	0.998457	0.049314	1.564471	0.640824	0.50375
03/01/2009	23:30	1.313111	0.667987	0.23132	-0.08819	0.034812	0.051662	2.151815	0.902811	0.263823	1.640633	0.641762	0.569969
04/01/2009	23:30	1.206873	0.519654	0.228859	-0.08783	0.034514	0.050708	2.258888	1.051755	0.8412	1.576147	0.641596	0.719069
05/01/2009	23:30	1.536031	0.556076	0.227363	-0.086554	0.045172	0.051434	2.28198	1.077427	0.858634	1.624316	0.640952	0.432181
06/01/2009	23:30	1.32293	0.582101	0.225383	-0.087461	0.044879	0.050164	2.279389	1.068017	0.86506	1.636741	0.824633	0.19389
07/01/2009	23:30	1.073863	0.609667	0.222876	-0.086205	0.06171	0.050954	2.282107	1.061355	0.870422	1.634178	0.825565	0.369663
08/01/2009	23:30	1.138457	0.631274	0.225063	-0.085955	0.059546	0.050301	2.296205	1.046604	0.877297	1.645878	0.820677	0.101433
09/01/2009	23:30	1.463632	0.651312	0.226438	-0.088231	0.069807	0.212426	2.308946	1.043195	0.877681	1.735527	0.8202	0.181807
10/01/2009	23:30	1.148241	0.656826	0.231954	-0.085257	0.061114	0.248388	2.386531	1.087609	0.891975	1.710493	0.822587	0.369975
11/01/2009	23:30	1.206604	0.695759	0.229516	-0.083032	0.077353	0.257	2.540675	1.242576	0.902311	1.679386	0.824196	0.484258
12/01/2009	23:30	1.242651	0.629799	0.232237	-0.083065	0.056557	0.050689	0.007569	1.302493	0.048868	1.599409	0.812204	0.479078
13/01/2009	23:30	1.198718	0.674404	0.222369	-0.082855	0.054781	0.252076	1.790897	0.812084	0.631191	1.575061	0.807628	0.35873
14/01/2009	23:30	1.082638	0.638097	0.23205	-0.081588	0.078633	0.049547	2.385857	1.199332	0.089799	1.413671	0.805498	0.561775
15/01/2009	23:30	1.389967	0.69266	0.226859	-0.081606	0.028413	0.050016	2.572426	1.437478	0.201062	1.557097	0.814543	0.833748
16/01/2009	23:30	1.326425	0.689468	0.229762	-0.078897	0.046546	0.049968	2.674727	1.460629	0.100044	1.493639	0.811136	0.620777
17/01/2009	23:30	2.280195	0.70822	0.24373	-0.08329	0.064922	0.29892	3.185963	1.972596	0.871486	3.967527	0.82249	0.979259
18/01/2009	23:30	3.392875	0.887282	0.24419	-0.082076	0.095172	0.314868	3.206561	2.359948	0.940083	4.480218	0.83015	0.993296
19/01/2009	23:30	3.586685	1.110886	0.242306	-0.081885	0.107223	0.324605	3.355269	3.648532	0.970326	4.603792	0.836216	0.903704
20/01/2009	23:30	3.55211	1.051346	0.154079	-0.081819	0.055709	0.306962	2.911931	4.106813	0.910124	4.178794	0.836733	0.944714
21/01/2009	23:30	3.568323	0.974131	0.161151	-0.080426	0.071616	0.316291	3.128641	4.512629	0.966436	3.941867	0.836924	0.938833
22/01/2009	23:00	2.601333	0.690499	0.175634	-0.076921	0.017519	0.050638	3.028757	4.816788	0.189572	1.421007	0.837757	0.867726
23/01/2009	23:30	2.86045	0.786265	0.243705	-0.076928	0.016652	0.311371	3.144507	5.298822	0.941674	4.343062	0.845914	1.084278
24/01/2009	23:30	3.479459	0.87812	0.26395	-0.077269	0.016601	0.317101	3.212927	5.728012	0.973936	4.441273	0.851453	1.095279
25/01/2009	23:30	3.5666	0.969515	0.237871	-0.075225	0.017466	0.318101	3.234135	6.004121	0.96356	4.436752	0.850108	1.097673
26/01/2009	23:30	3.252097	0.734617	0.239982	-0.069086	0.017332	0.280003	2.352459	5.832012	0.703916	2.441603	0.694912	0.98373
27/01/2009	23:30	2.143157	0.623437	0.238998	-0.070651	0.01688	0.278875	2.380789	5.897216	0.700104	2.377666	0.690656	0.987417
28/01/2009	23:30	1.447089	0.676543	0.238262	-0.085271	0.016839	0.050811	2.352707	5.797673	0.046144	1.627184	0.679022	0.816038
29/01/2009	23:30	2.241173	0.688623	0.245423	-0.070549	0.016282	0.296629	3.119176	6.478895	0.896695	1.340449	0.671493	0.852089
30/01/2009	23:30	3.651723	1.335939	0.486614	-0.075961	0.015538	0.330788	3.459102	6.819023	1.001735	4.857355	0.681878	0.988452
31/01/2009	23:30	3.637448	2.12519	1.339814	0.586404	0.604445	0.32352	3.382512	6.655989	0.987741	4.551605	0.699533	1.01733
01/02/2009	23:30	3.584284	2.294895	1.465638	0.730835	0.775343	0.310989	3.229989	6.615377	0.962019	4.330817	0.700474	1.014355
02/02/2009	23:30	3.589441	2.021555	1.200269	0.489923	0.496529	0.293681	2.807892	6.616674	0.813294	2.547122	0.705168	0.981718
03/02/2009	23:30	3.576221	1.893704	1.066291	0.384197	0.369131	0.292684	2.931058	6.597656	0.833158	2.357225	0.705644	0.979921

Date & Time	B.LE8 leve	B.LE7 leve	B.LE9 leve	B.LE10 lev	B.LE11 lev	B.LE6 leve	B.LGE6 lev	B.LGE8 lev	B.LGE7 lev	B.LE4 leve	B.LE2 leve	B.LC4 leve
04/02/2009 23:30	3.624139	1.338278	0.77771	-0.076687	0.144581	0.288318	2.792412	6.593247	0.820389	1.751165	0.694873	0.977456
05/02/2009 23:30	3.513762	0.637705	0.540437	-0.073778	0.019148	0.269936	2.259059	6.519869	0.459714	1.954788	0.698221	0.978528
06/02/2009 23:30	2.55419	0.616693	0.562211	-0.073088	0.022834	0.27694	2.061391	6.33237	0.735161	1.907853	0.691156	1.002556
07/02/2009 23:30	1.712983	0.555117	0.57601	-0.073514	0.023802	0.275307	2.253292	6.019377	0.844732	1.903065	0.686982	1.00947
08/02/2009 23:30	1.321362	0.628644	0.581033	-0.075098	0.022969	0.27191	2.289111	5.790382	0.769991	1.716107	0.682761	0.751947
09/02/2009 23:30	1.359583	0.683022	0.582879	-0.072713	0.024987	0.050963	2.023836	5.498813	0.070998	1.702674	0.670326	0.540318
10/02/2009 23:30	1.281588	0.722472	0.357278	-0.074681	0.024162	0.254881	2.276758	5.306994	0.827978	1.679304	0.64644	0.32558
11/02/2009 23:30	1.09883	0.758932	0.032625	-0.071974	0.025426	0.050727	2.038098	5.148133	0.153207	1.434468	0.627237	0.3646
12/02/2009 23:30	1.366154	0.636944	0.208789	-0.071301	0.025939	0.050724	2.297554	4.719225	0.82953	1.676196	0.601581	0.693153
13/02/2009 23:30	1.446113	0.61096	0.253404	-0.071862	0.024755	0.050275	2.419026	4.099302	0.854328	1.639533	0.579841	0.491218
14/02/2009 23:30	1.42064	0.596526	0.250769	-0.071026	0.025568	0.050491	2.489125	3.899902	0.862338	1.584975	0.554494	0.718105
15/02/2009 23:30	1.264519	0.636297	0.236401	-0.070613	0.026028	0.049978	2.523637	4.082652	0.87181	1.681515	0.539223	0.826634
16/02/2009 23:30	0.999005	0.665186	0.235767	-0.070372	0.026061	0.049604	2.543343	3.259965	0.884433	1.779883	0.536947	0.780779
17/02/2009 23:30	1.325423	0.565148	0.245162	-0.071134	0.028225	0.04921	2.547778	2.616002	0.892957	1.437337	0.537117	0.711985
18/02/2009 23:30	1.090002	0.605925	0.243921	-0.07547	0.035405	0.049834	2.583926	2.294746	0.901323	1.668842	0.537664	0.645831
19/02/2009 23:30	1.489943	0.644205	0.245559	-0.081422	0.032219	0.050503	2.562156	2.061496	0.897632	1.80748	0.538014	0.493337
20/02/2009 23:30	1.311334	0.672522	0.24733	-0.081023	0.031092	0.050531	2.555616	1.834413	0.897864	1.612835	0.538166	0.564052
21/02/2009 23:30	1.479828	0.563914	0.246032	-0.077603	0.037047	0.050279	2.545753	1.781039	0.900496	1.677307	0.538932	0.685409
22/02/2009 23:30	1.265078	0.596778	0.245383	-0.080495	0.04494	0.049688	2.554301	1.807106	0.900791	1.592574	0.538843	0.778797
23/02/2009 23:00	1.555414	0.62359	0.241734	-0.08259	0.03987	0.049663	2.56946	1.549914	0.905439	1.713363	0.539475	0.640532
24/02/2009 23:30	1.158568	0.649415	0.241519	-0.083134	0.043104	0.208475	2.566359	1.390185	0.904057	1.583998	0.53953	0.593539
25/02/2009 23:30	1.498965	0.670857	0.244151	-0.08139	0.048592	0.050324	2.114735	1.228768	0.054756	1.602049	0.533803	0.39729
26/02/2009 23:30	1.492753	0.620057	0.250028	-0.080047	0.028577	0.050486	2.350876	1.134005	0.835792	1.749203	0.5214	0.12659
27/02/2009 23:30	1.133755	0.606164	0.262588	-0.080442	0.027359	0.049707	2.468671	1.053914	0.873341	1.591955	0.519217	0.179528
28/02/2009 23:30	1.48892	0.633835	0.259477	-0.079527	0.031323	0.049764	2.574707	1.083659	0.895321	1.641158	0.520186	0.250478
01/03/2009 23:30	1.289817	0.660163	0.23433	-0.087254	0.033453	0.050118	2.544905	1.084725	0.890365	1.601626	0.517345	0.418759
02/03/2009 23:30	1.096941	0.662633	0.250349	-0.082088	0.032061	0.04996	2.539598	1.005255	0.895638	1.644192	0.517836	0.30974
03/03/2009 23:30	1.098502	0.732344	0.254531	-0.084292	0.046414	0.049469	2.817329	1.235066	0.921398	1.423158	0.520164	0.508126
04/03/2009 23:30	1.415713	0.582087	0.275535	-0.076838	0.034864	0.049311	3.041027	1.308749	0.937257	0.63711	0.521747	0.925842
05/03/2009 23:30	1.247436	0.623115	0.271882	-0.082433	0.036974	0.050007	2.007469	1.257148	0.043111	0.599358	0.519112	0.870669
06/03/2009 23:30	1.361643	0.577622	0.264753	-0.077505	0.051737	0.049776	2.422549	1.207802	0.822068	0.5921	0.520175	0.805833
07/03/2009 23:30	1.240695	0.623569	0.291133	-0.076427	0.029612	0.049457	2.614369	1.227087	0.882767	0.594421	0.520208	0.918123
08/03/2009 23:30	1.678462	0.672612	0.301944	-0.082427	0.031634	0.264327	2.742765	1.424626	0.902919	2.92901	0.521171	0.991119
09/03/2009 23:30	2.225432	0.793298	0.308409	-0.07861	0.030234	0.278565	2.964901	1.451382	0.923237	4.306448	0.518792	0.958758
10/03/2009 23:30	2.572723	0.703246	0.251794	-0.088776	0.029406	0.275969	2.444476	1.384266	0.836681	3.206273	0.528718	0.942454

Date & Time	B.LE8 leve	B.LE7 leve	B.LE9 leve	B.LE10 lev	B.LE11 lev	B.LE6 leve	B.LGE6 lev	B.LGE8 lev	B.LGE7 lev	B.LE4 leve	B.LE2 leve	B.LC4 leve
11/03/2009 23:30	2.276473	0.712275	0.269272	-0.07922	0.028978	0.278808	2.676247	1.292015	0.900601	2.456221	0.529053	0.92872
12/03/2009 23:30	1.834881	0.704309	0.278225	-0.078114	0.030789	0.271299	2.112703	1.242763	0.82399	2.081717	0.529008	0.931806
13/03/2009 23:30	1.438742	0.629127	0.295786	-0.081966	0.02563	0.27521	2.160308	1.209215	0.812207	1.936024	0.527091	0.908467
14/03/2009 23:30	1.780037	0.663932	0.293825	-0.099805	0.031925	0.268856	2.314543	1.250811	0.865049	2.601649	0.524519	0.901309
15/03/2009 23:30	1.666476	0.61135	0.297546	-0.07768	0.031477	0.263754	2.390561	1.281675	0.874435	2.944244	0.523994	0.989483
16/03/2009 23:30	1.399805	0.559153	0.313459	-0.072723	0.032206	0.049832	1.84035	1.176496	0.271418	0.593307	0.519608	0.76057
17/03/2009 23:30	1.367436	0.527037	0.32192	-0.074021	0.031058	0.049608	2.16162	1.168432	0.263362	0.583653	0.499318	0.898555
18/03/2009 23:30	1.091106	0.563799	0.294162	-0.074571	0.031449	0.049568	2.292552	1.145303	0.84099	1.529082	0.496226	0.725673
19/03/2009 23:30	1.478027	0.589885	0.301924	-0.077576	0.031758	0.049026	2.376972	1.114373	0.85705	1.976829	0.495724	0.449783
20/03/2009 23:30	1.345005	0.580855	0.310995	-0.076507	0.032504	0.049251	2.38209	1.054095	0.859047	1.392438	0.495849	0.575989
21/03/2009 23:30	1.031539	0.606163	0.290902	-0.080029	0.033181	0.049074	2.328613	1.027211	0.855685	1.775898	0.495538	0.67387
22/03/2009 23:30	1.439103	0.611161	0.293511	-0.073274	0.038103	0.050063	2.33172	0.987465	0.865929	2.042481	0.496508	0.684522
23/03/2009 23:30	1.40535	0.550699	0.30191	-0.076599	0.03984	0.049673	2.39787	0.911161	0.8789	1.705962	0.496429	0.555473
24/03/2009 23:30	1.180661	0.570414	0.309605	-0.073117	0.033359	0.049295	2.455508	0.916065	0.892204	1.82726	0.497723	0.65768
25/03/2009 23:30	1.49442	0.600764	0.306787	-0.07253	0.029447	0.050036	2.480794	0.862406	0.899228	2.124273	0.498547	0.330899
26/03/2009 23:30	1.452885	0.557099	0.338603	-0.080384	0.036954	0.04989	2.53141	0.881805	0.901643	1.407799	0.498911	0.495438
27/03/2009 23:30	1.401387	0.516259	0.339777	-0.082979	0.033774	0.050415	2.563175	1.022604	0.902354	1.947168	0.499648	0.501647
28/03/2009 23:30	1.115485	0.552708	0.315474	-0.086989	0.033666	0.049654	2.483305	0.959362	0.887146	2.189641	0.499321	0.593862
29/03/2009 23:30	1.42821	0.581524	0.338615	-0.087462	0.041855	0.050048	2.483311	0.93318	0.877922	2.393794	0.499874	0.613435
30/03/2009 23:30	1.175957	0.559668	0.343047	-0.085426	0.041527	0.049912	2.424337	0.942802	0.863455	2.543893	0.50042	0.408029
31/03/2009 23:30	1.530432	0.546704	0.348252	-0.073637	0.021177	0.050568	2.389566	0.879709	0.862535	1.901335	0.500942	0.446066
01/04/2009 23:30	1.308751	0.552233	0.336968	-0.075596	0.034458	0.050305	2.374399	0.883049	0.85816	1.372532	0.500962	0.042423
02/04/2009 23:30	0.987231	0.552096	0.342023	-0.073688	0.032472	0.04977	2.396372	0.967926	0.860902	1.690675	0.502406	0.311923
03/04/2009 23:30	1.384987	0.584388	0.331599	-0.074956	0.041318	0.050096	2.469177	1.14581	0.869443	1.880082	0.503089	0.356652
04/04/2009 23:30	1.230094	0.534485	0.29903	-0.073351	0.038108	0.049694	2.438145	1.15242	0.853472	2.097424	0.502971	0.488094
05/04/2009 23:30	1.449486	0.569603	0.303466	-0.070263	0.036852	0.049473	2.476499	1.174237	0.864986	2.280001	0.504322	0.499636
06/04/2009 23:30	1.31645	0.559679	0.309387	-0.072946	0.035184	0.049749	2.619996	1.197689	0.876507	2.083923	0.505131	0.476344
07/04/2009 23:30	1.036767	0.582144	0.314753	-0.074868	0.037923	0.050221	2.697593	1.21892	0.888415	1.545751	0.505314	0.362723
08/04/2009 23:30	1.42076	0.59965	0.304034	-0.073438	0.037361	0.050079	2.6149	1.230285	0.880953	0.591709	0.506902	0.10242
09/04/2009 23:30	1.443377	0.61052	0.314056	-0.078656	0.039821	0.04951	2.831005	1.278604	0.88817	1.771944	0.507377	0.415685
10/04/2009 23:30	0.841334	0.603248	0.287453	-0.081491	0.037608	0.050052	2.807444	1.356688	0.893137	2.386616	0.509156	0.57374
11/04/2009 23:30	1.255417	0.563829	0.270258	-0.081932	0.040159	0.05133	2.717216	1.386241	0.889596	2.756703	0.510821	0.613552
12/04/2009 23:30	1.513996	0.507427	0.261663	-0.072741	0.042403	0.050039	2.683171	1.411363	0.892862	3.001733	0.511485	0.660426
13/04/2009 23:30	1.291371	0.565449	0.259573	-0.077798	0.038	0.049948	2.720041	1.443253	0.900512	3.28067	0.511802	0.742143
14/04/2009 23:30	1.55813	0.615241	0.258065	-0.08823	0.046679	0.05078	2.689389	1.333165	0.894793	1.871435	0.513046	0.563839

Date & Time	B.LE8 leve	B.LE7 leve	B.LE9 leve	B.LE10 lev	B.LE11 lev	B.LE6 leve	B.LGE6 lev	B.LGE8 lev	B.LGE7 lev	B.LE4 leve	B.LE2 leve	B.LC4 leve
15/04/2009 23:30	1.418827	0.637424	0.260595	-0.068548	0.037252	0.051844	2.725085	1.245328	0.901189	2.097941	0.514622	0.409164
16/04/2009 23:30	1.12037	0.512744	0.258255	-0.07391	0.035872	0.051156	2.724324	1.193309	0.897441	1.982127	0.514311	0.486898
17/04/2009 23:30	1.436929	0.458716	0.255476	-0.080087	0.036367	0.051461	2.697371	0.3058	0.894852	1.665141	0.515355	0.331413
18/04/2009 23:30	1.07832	0.497233	0.253979	-0.087074	0.037	0.051459	2.646424	0.305552	0.887494	1.709025	0.51556	0.483754
19/04/2009 23:30	1.379799	0.529764	0.248197	-0.080378	0.036148	0.051739	2.596121	0.306332	0.88293	1.578119	0.515866	0.507173
20/04/2009 23:30	1.03496	0.557471	0.25299	-0.070958	0.038633	0.051366	2.549521	0.307436	0.878554	1.559564	0.510798	0.279436
21/04/2009 23:30	1.294562	0.58202	0.251035	-0.069206	0.042315	0.051303	2.5216	0.304241	0.878611	1.616411	0.517899	0.348821
22/04/2009 23:30	1.510205	0.60609	0.262832	-0.075215	0.035773	0.051144	2.545918	0.305051	0.886771	1.674448	0.518173	0.37515
23/04/2009 23:30	1.207292	0.630193	0.264199	-0.072304	0.036948	0.051376	2.612453	0.305405	0.889	1.622055	0.518249	0.50661
24/04/2009 23:30	1.558305	0.711623	0.265408	-0.077377	0.036296	0.17947	2.819326	0.294609	0.904718	1.378536	0.514042	0.392314
25/04/2009 23:30	1.429045	0.825426	0.267923	-0.07932	0.043197	0.054678	2.502112	0.459646	0.047567	1.567877	0.517083	0.715726
26/04/2009 23:30	1.380635	0.860609	0.276119	-0.07453	0.046431	0.054949	2.768568	0.506569	0.216703	3.164725	0.518844	0.825472
27/04/2009 23:30	1.49076	0.64319	0.267063	-0.081059	0.046371	0.272642	2.910543	0.48154	0.873824	4.209138	0.516998	0.982316
28/04/2009 23:30	2.127885	0.745073	0.268772	-0.077987	0.046184	0.295002	2.97931	0.7278	0.906491	4.383326	0.520653	0.905444
29/04/2009 23:30	1.931407	0.788471	0.274434	-0.074616	0.050977	0.289198	2.734672	0.588465	0.852794	3.310115	0.519691	0.939251
30/04/2009 23:30	1.904354	0.856405	0.267253	-0.094938	0.044578	0.289939	2.777479	0.508259	0.892843	3.311026	0.520541	0.935198
01/05/2009 23:30	1.678991	0.891249	0.275197	-0.098316	0.044161	0.276899	2.357402	0.550564	0.832496	2.589473	0.519737	0.963389
02/05/2009 23:30	1.892611	0.914769	0.278916	-0.079091	0.040173	0.273849	2.551328	0.595312	0.874278	3.404675	0.518438	0.964417
03/05/2009 23:30	2.023535	0.934803	0.274482	-0.074312	0.042796	0.268708	2.58274	0.628686	0.876406	3.779726	0.51947	0.959899
04/05/2009 23:30	2.133926	0.952514	0.294456	-0.066012	0.043698	0.268907	2.636681	0.661423	0.885585	3.982235	0.520165	0.961765
05/05/2009 23:30	1.897901	0.969031	0.316443	-0.061547	0.03695	0.269844	2.658213	0.474693	0.891448	2.473172	0.520813	0.918364
06/05/2009 23:30	1.164066	0.985485	0.337015	-0.073125	0.046858	0.272387	2.700792	0.292612	0.894347	1.322094	0.521358	0.931077
07/05/2009 23:30	1.697842	0.620131	0.294169	-0.085042	0.042526	0.268436	2.310964	0.286403	0.804041	1.751501	0.518609	0.924676
08/05/2009 23:30	1.56205	0.54508	0.28561	-0.07011	0.03295	0.25816	1.73561	0.28663	0.68127	2.26844	0.51572	1.00331
09/05/2009 23:30	1.75712	0.576	0.29018	-0.08086	0.05161	0.26724	2.17495	0.27324	0.8488	2.60659	0.51373	0.99718
10/05/2009 23:30	1.86773	0.60049	0.29242	-0.07227	0.0536	0.2649	2.2685	0.26688	0.84977	2.81618	0.5129	0.99653
11/05/2009 23:30	1.17534	0.43925	0.2932	-0.06935	0.04593	0.05192	1.81051	0.29384	0.7964	1.43883	0.5133	0.97779
12/05/2009 23:30	1.45941	0.46886	0.30274	-0.05679	0.0403	0.05301	1.34019	0.30398	0.04036	1.42705	0.51291	0.72239
13/05/2009 23:30	1.16062	0.49875	0.30241	-0.05856	0.04377	0.0522	1.92801	0.30395	0.83153	1.42385	0.51259	0.87409
14/05/2009 23:30	1.41983	0.52965	0.30957	-0.06134	0.05635	0.05169	2.61004	0.31182	0.86609	1.32571	0.51393	0.82533
15/05/2009 23:30	1.45164	0.52287	0.30153	-0.09098	0.04903	0.05237	2.70611	0.38882	0.89807	1.29242	0.51729	0.85242
16/05/2009 23:30	1.68847	0.62987	0.2967	-0.1016	0.05079	0.27817	2.90836	0.5802	0.91486	2.83182	0.51909	0.98547
17/05/2009 23:30	2.19	0.75663	0.29873	-0.08849	0.0538	0.29789	3.06432	0.82629	0.92524	4.23497	0.52269	0.99596
18/05/2009 23:30	2.4176	0.73864	0.29434	-0.11628	0.04966	0.30206	3.12446	0.92876	0.92131	4.42881	0.5255	0.98815
19/05/2009 23:30	3.23375	0.68912	0.29165	-0.12493	0.07633	0.3	3.1024	0.83947	0.91793	1.29189	0.52777	0.9493

Date & Time	B.LE8 leve	B.LE7 leve	B.LE9 leve	B.LE10 lev	B.LE11 lev	B.LE6 leve	B.LGE6 lev	B.LGE8 lev	B.LGE7 lev	B.LE4 leve	B.LE2 leve	B.LC4 leve
20/05/2009 23:30	3.47281	0.66764	0.2883	-0.11602	0.12379	0.2968	2.75873	0.88148	0.89366	3.82449	0.52498	1.0058
21/05/2009 23:30	3.39488	0.63022	0.28414	-0.10139	0.05787	0.28962	2.30756	0.75902	0.80125	2.41419	0.526	0.99313
22/05/2009 23:30	2.93603	0.66595	0.28615	-0.09592	0.04957	0.29694	2.70995	0.81885	0.89725	2.26102	0.52668	1.00192
23/05/2009 23:30	3.28728	0.74373	0.2848	-0.11357	0.04418	0.29653	2.85356	0.95573	0.89757	3.7343	0.52782	1.00631
24/05/2009 23:30	3.38604	0.77198	0.28867	-0.09379	0.03853	0.2963	2.85313	1.00278	0.89316	4.06055	0.52925	1.00223
25/05/2009 23:30	3.33976	0.71887	0.28967	-0.09079	0.04004	0.29239	2.84244	0.91858	0.8912	2.87618	0.52919	0.97599
26/05/2009 23:30	3.39699	0.74613	0.29156	-0.07803	0.04087	0.28638	2.7834	0.95758	0.88749	3.48109	0.53039	0.9726
27/05/2009 23:30	3.47348	0.8213	0.29256	-0.09927	0.04139	0.28579	2.92542	0.98534	0.88766	4.07787	0.53092	0.91864
28/05/2009 23:30	3.43346	0.57185	0.29254	-0.08077	0.0379	0.28602	2.85227	0.77854	0.86112	1.31278	0.52617	0.90977
29/05/2009 23:30	2.66488	0.54524	0.28573	-0.07416	0.03845	0.28757	2.85083	0.57739	0.89714	2.00179	0.51779	0.99066
30/05/2009 23:30	2.92865	0.57747	0.28497	-0.09162	0.03977	0.28491	2.80263	0.61104	0.90055	2.65063	0.51677	0.98277
31/05/2009 23:30	3.07938	0.60497	0.2861	-0.08619	0.04352	0.28085	2.73903	0.63977	0.90146	3.00863	0.51692	0.97792
01/06/2009 23:30	3.16191	0.62783	0.28755	-0.07675	0.04229	0.27839	2.70427	0.66637	0.89749	3.27719	0.51691	0.97265
02/06/2009 23:30	2.68023	0.54453	0.28762	-0.06958	0.04254	0.27636	2.6778	0.44985	0.88938	1.99405	0.51729	0.95273
03/06/2009 23:30	2.40739	0.5397	0.29621	-0.06915	0.05516	0.27658	2.6638	0.38042	0.89461	1.7717	0.51772	1.0072
04/06/2009 23:30	2.00584	0.55233	0.29799	-0.06555	0.04923	0.27087	2.65917	0.2963	0.89194	1.68161	0.51836	0.94069
05/06/2009 23:30	1.20901	0.56742	0.29583	-0.07182	0.06015	0.26844	2.69269	0.29421	0.89832	1.73171	0.5186	0.98909
06/06/2009 23:30	1.55974	0.61282	0.30274	-0.0708	0.05239	0.27465	2.79335	0.3291	0.90041	2.2872	0.51898	1.00118
07/06/2009 23:30	1.77324	0.65908	0.30012	-0.07218	0.04758	0.27279	2.77887	0.36928	0.89207	2.63355	0.51889	0.99719
08/06/2009 23:30	1.6722	0.51847	0.29791	-0.07508	0.05871	0.26301	2.7467	0.32192	0.87946	1.69565	0.51955	0.95386
09/06/2009 23:30	1.33221	0.54208	0.29351	-0.0832	0.04593	0.26463	2.65758	0.35476	0.86475	1.62723	0.51841	0.92305
10/06/2009 23:30	1.39098	0.47791	0.2947	-0.09062	0.04834	0.04874	2.60497	0.3874	0.82381	1.31375	0.50946	0.87484
11/06/2009 23:30	1.20668	0.45053	0.2909	-0.06817	0.03961	0.04952	2.55299	0.37339	0.82984	1.31823	0.49354	0.84657
12/06/2009 23:30	1.43076	0.47346	0.2947	-0.07255	0.04751	0.04881	2.54159	0.38969	0.8406	1.33575	0.49225	0.65862
13/06/2009 23:30	1.20493	0.48493	0.31125	-0.07447	0.04706	0.04974	2.65329	0.4065	0.84203	1.37702	0.4925	0.81056
14/06/2009 23:30	1.08746	0.60793	0.31226	-0.07039	0.04653	0.18258	2.92999	0.44401	0.87834	1.48912	0.49282	0.91077
15/06/2009 23:30	1.17737	0.77652	0.31194	-0.08107	0.04293	0.04965	3.10686	0.76502	0.87394	1.31141	0.49656	0.94828
16/06/2009 23:30	1.1144	0.60959	0.31008	-0.06251	0.04418	0.2592	3.01178	0.7854	0.9228	1.71928	0.4977	1.00506
17/06/2009 23:30	2.47639	1.08189	0.44202	-0.10457	0.03473	0.29544	3.27201	1.73266	0.96941	4.39135	0.50946	1.03192
18/06/2009 23:30	3.47501	0.75428	0.32886	-0.08862	0.05841	0.29072	3.18199	1.35546	0.9437	2.43234	0.52547	0.94929
19/06/2009 23:30	3.31829	0.56227	0.34937	-0.08473	0.05753	0.27806	3.05758	1.13664	0.93644	1.98857	0.52677	0.98953
20/06/2009 23:30	3.37888	0.60479	0.40484	-0.08766	0.04919	0.27755	2.97598	1.18331	0.93199	2.72572	0.52729	0.98469
21/06/2009 23:30	3.41058	0.63607	0.48561	-0.07384	0.03601	0.27744	2.92371	1.22478	0.92774	3.12174	0.52759	0.9834
22/06/2009 23:30	-0.99994	-1.24998	-1.25	-0.08854	0.03199	0.27633	2.86906	1.20851	0.92205	1.3587	0.52864	0.76818
23/06/2009 23:30	1.8187	1.32607	0.05116	-0.06816	0.02555	0.05044	2.86447	0.98693	0.02121	1.45575	0.52929	0.98783

Date & Time	B.LE8 leve	B.LE7 leve	B.LE9 leve	B.LE10 lev	B.LE11 lev	B.LE6 leve	B.LGE6 lev	B.LGE8 lev	B.LGE7 lev	B.LE4 leve	B.LE2 leve	B.LC4 leve
24/06/2009 23:30	1.12154	1.31146	0.2052	-0.09012	0.00174	0.27038	2.88609	0.79873	0.4554	1.45572	0.53008	0.98455
25/06/2009 23:30	1.11971	0.58505	0.23883	-0.08374	-0.00132	0.2753	2.89366	0.5926	0.22395	1.41226	0.53083	0.88649
26/06/2009 23:30	1.3651	0.53969	0.24572	-0.09569	0.01364	0.27394	2.85331	0.63209	0.83101	1.35183	0.53061	0.94913
27/06/2009 23:30	1.6171	0.56263	0.24158	-0.0952	0.02163	0.27253	2.81809	0.65726	0.8477	1.69418	0.53157	0.94628
28/06/2009 23:30	1.78522	0.58376	0.24245	-0.06799	0.0057	0.27333	2.82638	0.68146	0.85397	2.00553	0.53169	0.95012
29/06/2009 23:00	1.21558	0.59484	0.24458	-0.09155	0.00374	0.05122	2.77219	0.50236	0.79929	1.53597	0.53176	0.77386
30/06/2009 23:30	1.20218	0.53183	0.24883	-0.10233	0.02197	0.05134	2.72396	0.34417	0.84114	1.36604	0.53233	0.62983
01/07/2009 23:30	1.44453	0.55274	0.25548	-0.08845	0.0357	0.05134	2.70522	0.36349	0.81522	1.40904	0.53283	0.47635
02/07/2009 23:30	1.12851	0.55065	0.26393	-0.06449	0.04113	0.21107	2.85049	0.32368	0.80317	1.3635	0.53408	0.53426
03/07/2009 23:30	1.39377	0.5754	0.26742	-0.06778	0.06559	0.05058	2.87948	0.34575	0.73226	1.40058	0.53448	0.27906
04/07/2009 23:30	0.98291	0.59879	0.26341	-0.07189	0.06889	0.0501	2.87196	0.35877	0.83655	1.37556	0.53458	0.42656
05/07/2009 23:30	1.50483	0.46159	0.26712	-0.0735	0.07933	0.05111	2.95514	0.35428	0.85127	1.31243	0.5349	0.53269
06/07/2009 23:30	1.5029	0.68549	0.30235	-0.29398	0.04172	0.26251	3.32025	0.99593	0.9253	3.45674	0.54675	0.98348
07/07/2009 23:30	2.038673	1.414777	-1.656264	-0.145763	0.016905	0.284528	3.186583	0.526135	7.462702	4.21623	0.550254	0.95903
08/07/2009 23:30	2.982481	0.707566	-1.548727	-0.142958	0.016007	0.051335	3.096792	0.32197	4.909401	1.29993	0.551665	0.969136
09/07/2009 23:30	3.124871	1.065057	-1.602973	-0.143744	0.016152	0.27951	3.044369	0.149596	7.213894	2.151397	0.553333	0.991824
10/07/2009 23:30	2.180276	1.08658	-1.606312	-0.14409	-0.00259	0.272522	3.1229	0.116999	6.696813	1.888118	0.73791	0.98444
11/07/2009 23:30	2.964964	1.411728	-1.655995	-0.142288	0.023198	0.306665	3.371326	0.40443	7.9117	4.494847	0.7437	1.00134
12/07/2009 23:30	3.356994	1.518868	-1.672265	-0.140975	0.019056	0.31016	3.307928	0.515288	8.065042	4.276032	0.747048	1.002125
13/07/2009 23:30	3.442539	1.507471	-1.670601	-0.140048	0.01913	0.310043	3.31687	0.409239	8.03735	4.000481	0.748502	0.939827
14/07/2009 23:30	3.53023	1.160598	-1.617669	-0.140702	0.023671	0.303093	3.388174	0.435116	7.227462	3.704639	0.74511	1.001608
15/07/2009 23:30	3.301271	1.174368	-1.619666	-0.139349	0.019049	0.305558	3.305536	0.289528	7.394443	3.18115	0.745438	1
16/07/2009 23:30	3.210309	1.129714	-1.612945	-0.13983	0.02013	0.305875	3.238542	0.140918	7.859716	2.593693	0.746503	0.952895
17/07/2009 23:30	1.615352	1.050294	-1.600672	-0.138037	0.019908	0.305832	3.184134	0.067906	7.453258	1.876073	0.737869	1.000838
18/07/2009 23:30	1.919902	1.112166	-1.61023	-0.139538	0.018766	0.301951	3.169381	0.091751	7.798961	2.688722	0.737655	1.005409
19/07/2009 23:30	2.08592	1.166158	-1.618359	-0.138165	0.019327	0.298985	3.119962	0.117584	7.83277	3.180595	0.737849	1.002164
20/07/2009 23:30	1.339031	0.710348	-1.549187	-0.138066	0.016104	0.300221	3.081431	0.060688	7.882354	1.302253	0.739339	0.814481
21/07/2009 23:30	1.303807	0.712963	-1.549578	-0.137122	0.002996	0.303201	3.136493	0.04869	0.799915	1.345911	0.724279	0.772305
22/07/2009 23:30	1.165735	0.710633	-1.549257	-0.137431	0.02098	0.300546	3.102177	0.040394	0.841491	1.315177	0.695816	0.716618
23/07/2009 23:30	0.875222	0.710357	-1.549156	-0.138863	0.016644	0.29488	3.125885	0.055497	0.847935	1.292864	0.667461	0.727319
24/07/2009 23:30	1.63632	0.710091	-1.549104	-0.136167	0.023045	0.293636	3.132678	0.037267	0.872994	1.31273	0.641202	0.628465
25/07/2009 23:30	1.554965	0.711362	-1.549398	-0.136136	0.001717	0.305332	3.116429	0.013226	0.871178	1.307564	0.621733	0.77096
26/07/2009 23:30	1.493952	0.7112	-1.54926	-0.134541	0.01311	0.313583	3.153671	0.067342	0.881533	1.364288	0.603027	0.913622
27/07/2009 23:30	1.311804	0.712033	-1.549379	-0.135198	0.018671	0.313446	3.092021	0.037697	0.856883	1.403491	0.605924	0.529874
28/07/2009 23:30	1.027515	0.709955	-1.549176	-0.134849	0.017092	0.314388	3.077917	0.023236	0.85339	1.329509	0.604752	0.45633

Date & Time	B.LE8 leve	B.LE7 leve	B.LE9 leve	B.LE10 lev	B.LE11 lev	B.LE6 leve	B.LGE6 lev	B.LGE8 lev	B.LGE7 lev	B.LE4 leve	B.LE2 leve	B.LC4 leve
29/07/2009 23:30	1.249552	0.710743	-1.5493	-0.133733	0.022092	0.3096	2.994278	0.023463	0.839101	1.357725	0.605441	0.562975
30/07/2009 23:30	0.846975	0.711804	-1.549323	-0.132933	0.016669	0.30467	2.887499	0.026587	0.841653	1.393559	0.606226	0.685676
31/07/2009 23:30	1.466987	0.709482	-1.549175	-0.13398	-0.010382	0.3019	3.011811	0.01172	0.844817	1.291862	0.607655	0.496047
01/08/2009 23:30	1.327038	0.710519	-1.549264	-0.132438	0.015954	0.298205	2.988023	0.019335	0.852592	1.317545	0.607908	0.599007
02/08/2009 23:30	1.065841	0.711079	-1.549456	-0.132791	-0.008504	0.302541	2.974302	0.032594	0.853757	1.397271	0.609202	0.698352
03/08/2009 23:30	1.061812	0.707423	-1.548749	-0.131908	0.005172	0.304127	3.049448	0.061525	0.858873	1.290831	0.609496	0.799035
04/08/2009 23:30	1.555245	0.709993	-1.549059	-0.130512	0.016074	0.313541	3.026036	0.030054	0.857416	1.397302	0.605637	0.135889
05/08/2009 23:30	1.368259	0.710034	-1.549113	-0.130247	0.022033	0.30947	2.918863	0.028491	0.856275	1.398629	0.605053	0.421404
06/08/2009 23:30	1.069334	0.712212	-1.54939	-0.129606	0.021279	0.308214	2.825951	0.026456	0.855784	1.264389	0.606373	0.573895
07/08/2009 23:30	1.412875	0.710593	-1.549239	-0.129375	0.014609	0.306247	2.766483	0.02755	0.856572	1.311535	0.607084	0.330662
08/08/2009 23:30	1.09354	0.70833	-1.548948	-0.129625	0.021681	0.301908	2.745686	0.028105	0.855235	1.397524	0.607025	0.46158
09/08/2009 23:30	1.41551	0.708013	-1.548945	-0.128831	0.015848	0.299705	2.752745	0.033043	4.972224	1.509329	0.608393	0.46705
10/08/2009 23:30	1.122746	0.711912	-1.549385	-0.127891	0.02341	0.288994	2.720429	0.030028	0.86477	1.344951	0.609032	0.603346
11/08/2009 23:30	1.417342	0.710921	-1.549214	-0.126826	0.019419	0.281397	2.66199	0.023785	6.665968	1.358189	0.608553	0.481552
12/08/2009 23:30	1.121418	0.709735	-1.54914	-0.127246	0.026307	0.283446	2.651074	0.012612	6.968195	1.383644	0.609356	0.599569
13/08/2009 23:30	1.426457	0.711265	-1.549317	-0.126734	0.017356	0.283577	2.647934	0.038144	7.10422	1.348758	0.610395	0.330346
14/08/2009 23:30	1.129236	0.71017	-1.549096	-0.125525	0.02271	0.285548	2.680477	0.038666	7.248279	1.275389	0.611501	0.479545
15/08/2009 23:30	1.53181	0.70949	-1.549086	-0.126128	0.030187	0.279286	2.746812	0.026916	7.255631	1.306219	0.611212	0.495022
16/08/2009 23:30	1.293786	0.70854	-1.548958	-0.125961	0.025046	0.274713	2.735368	0.047617	7.261954	1.406735	0.610015	0.587517
17/08/2009 23:30	1.542661	0.709389	-1.548948	-0.116209	0.012396	0.272655	2.701933	0.068636	0.844334	1.419566	0.610901	0.324804
18/08/2009 23:30	1.307722	0.708322	-1.548828	-0.120731	-0.008212	0.273821	2.707339	0.089686	0.871917	1.417695	0.611855	0.479469
19/08/2009 23:30	0.846838	0.708229	-1.548757	-0.127251	-0.006203	0.275579	2.807306	0.053566	0.877566	1.279478	0.608713	0.609883
20/08/2009 23:30	1.101676	0.71012	-1.549242	-0.116564	0.010854	0.281174	2.983796	0.028194	0.878619	1.347642	0.613189	0.780117
21/08/2009 23:30	1.517558	0.710081	-1.549226	-0.121557	0.011126	0.283224	2.924795	0.022536	0.880858	1.272579	0.614448	0.652125
22/08/2009 23:30	1.339312	0.70938	-1.549125	-0.124614	-0.006212	0.285724	2.922064	0.023649	0.876638	1.31768	0.615715	0.746899
23/08/2009 23:30	1.253146	0.70932	-1.549184	-0.116878	0.031296	0.289542	3.054621	0.019987	0.879233	1.311822	0.616586	0.845443
24/08/2009 23:30	1.555969	0.417156	-1.25	-0.119763	0.033876	-1.25	3.061706	0.017196	4.893038	1.37262	0.617071	0.618045
25/08/2009 23:30	1.382057	0.689608	-1.249999	-0.15951	0.039142	0.074154	3.064404	1.096291	0.348159	1.430631	0.600871	0.498153
26/08/2009 23:30	1.184006	0.685172	-1.25	-0.157522	0.040162	0.074016	3.155241	1.164637	0.355517	1.512328	0.609048	0.638584
27/08/2009 23:30	1.090345	0.703973	-1.25	-0.156732	0.040878	0.074729	1.761051	0.697804	0.352758	1.666277	0.610505	0.544381
28/08/2009 23:30	1.490145	0.681426	-1.249999	-0.156258	0.033623	0.076205	2.743506	0.88658	0.356762	1.591143	0.616681	0.783311
29/08/2009 23:30	1.364788	1.095765	-1.25	-0.155895	0.024056	0.30696	2.780727	0.912744	6.090107	2.602749	0.620306	0.998094
30/08/2009 23:30	1.670659	1.177242	-1.249999	-0.154443	0.017831	0.324841	2.905774	0.964026	6.893311	3.550314	0.622647	1.004906
31/08/2009 23:30	2.394403	1.438845	-1.25	-0.154957	0.03232	0.333864	3.19793	1.184694	7.357483	4.568392	0.62828	0.935941
01/09/2009 23:30	2.153726	0.696526	-1.249999	-0.153622	0.027113	0.075702	2.703283	1.026892	0.352036	1.717119	0.631008	0.963541

Date & Time	B.LE8 leve	B.LE7 leve	B.LE9 leve	B.LE10 lev	B.LE11 lev	B.LE6 leve	B.LGE6 lev	B.LGE8 lev	B.LGE7 lev	B.LE4 leve	B.LE2 leve	B.LC4 leve
02/09/2009 23:30	3.42937	1.322182	-1.25	-0.154322	0.027351	0.343027	3.219271	1.302004	7.585619	4.718246	0.639038	1.022951
03/09/2009 23:30	3.37824	1.119891	-1.25	-0.153661	0.028953	0.315212	2.821048	1.377986	5.934739	3.000796	0.643315	0.985603
04/09/2009 23:30	2.38625	1.106141	-1.25	-0.152881	0.026101	0.308995	2.622573	1.261842	6.071703	2.634418	0.646136	0.987406
05/09/2009 23:30	2.675741	1.197079	-1.249999	-0.152287	0.024207	0.323878	2.793876	1.308724	7.327994	4.047653	0.648137	0.990161
06/09/2009 23:30	3.224767	1.362262	-1.249999	-0.151688	0.023597	0.3307	3.03226	1.453071	7.57465	4.381204	0.649544	1.005652
07/09/2009 23:30	2.3488	1.121253	-1.249999	-0.151607	0.023979	0.318396	2.612135	1.292455	6.655355	2.725824	0.652147	0.930407
08/09/2009 23:30	1.70376	1.13989	-1.25	-0.151335	0.024351	0.314675	2.373703	1.169825	6.661386	2.67853	0.652563	0.954059
09/09/2009 23:30	1.28147	1.119433	-1.25	-0.14848	0.023506	0.310673	1.794489	1.010312	6.556179	2.457622	0.653655	0.962707
10/09/2009 23:30	1.348878	0.683423	-1.25	-0.152542	0.023661	0.07594	1.636011	0.848918	6.752736	1.826715	0.654289	0.764164
11/09/2009 23:30	1.292522	0.665287	-1.25	-0.148721	0.023668	0.075306	2.120104	0.763022	0.369274	1.695102	0.655461	0.678172
12/09/2009 23:30	1.138793	0.653731	-1.25	-0.142086	0.023617	0.075513	2.28953	0.761231	0.367073	1.38483	0.655443	0.780701
13/09/2009 23:30	1.506689	0.716514	-1.25	-0.143362	0.023873	0.076304	2.389497	0.755652	0.374348	1.740466	0.656491	0.80263
14/09/2009 23:30	1.363255	0.649896	-1.25	-0.139962	0.023718	0.076042	2.442833	0.686889	0.370383	1.659993	0.656638	0.502595
15/09/2009 23:30	1.188637	0.692069	-1.25	-0.137024	0.023845	0.277408	2.449358	0.666453	5.640332	1.672146	0.657064	0.244099
16/09/2009 23:30	1.68165	0.683462	-1.25	-0.146937	0.023483	0.294289	2.466631	0.686758	6.736977	1.756054	0.6576	0.145874
17/09/2009 23:30	1.875806	0.704458	-1.249999	-0.151423	0.023639	0.075947	1.913839	0.626732	0.361909	1.646389	0.65865	0.168785
18/09/2009 23:30	2.039913	0.664177	-1.25	-0.149276	0.023394	0.075121	2.267572	0.585625	6.473925	1.738607	0.659091	0.254277
19/09/2009 23:30	2.215451	0.662708	-1.25	-0.145955	0.023647	0.074303	2.337192	0.577406	6.795765	1.723414	0.65869	0.26825
20/09/2009 23:30	2.369174	0.667364	-1.249999	-0.147625	0.023715	0.076835	2.353966	0.57432	6.89859	1.837105	0.659699	0.277794
21/09/2009 23:30	2.516711	0.688899	-1.25	-0.143514	0.02398	0.075758	2.388458	0.552575	6.98473	1.692862	0.660049	0.325902
22/09/2009 23:30	1.276852	0.661203	-1.25	-0.139156	0.023332	0.075399	2.381257	0.522406	7.000362	1.779258	0.659902	0.700825
23/09/2009 23:30	1.085691	0.699824	-1.249999	-0.143636	0.023264	0.075748	2.368656	0.49387	6.972819	1.714859	0.660734	0.794701
24/09/2009 23:30	1.418151	0.687459	-1.25	-0.137523	0.02437	0.076004	2.370059	0.471875	6.976803	1.792697	0.661158	0.809958
25/09/2009 23:30	1.209284	0.693482	-1.25	-0.137744	0.024109	0.075748	2.349936	0.433356	6.94571	1.693769	0.661457	0.895594
26/09/2009 23:30	1.473992	0.678914	-1.249999	-0.14481	0.023348	0.077442	2.344773	0.419231	6.936777	1.757649	0.661983	0.903138
27/09/2009 23:30	1.231017	1.058131	-1.25	-0.137078	0.02437	0.174115	2.319179	0.481151	6.955344	1.803774	0.661965	0.979058
28/09/2009 23:30	1.480479	0.671241	-1.249999	-0.135572	0.029802	0.075743	1.612073	0.382141	0.362437	1.565527	0.66267	0.724483
29/09/2009 23:30	1.246816	0.687195	-1.25	-0.140829	0.034786	0.076075	1.984433	0.30082	0.361233	1.847218	0.662725	0.811061
30/09/2009 23:30	1.488469	0.689487	-1.249999	-0.137538	0.038191	0.077797	2.121701	0.228234	0.775485	1.735124	0.663806	0.824901
01/10/2009 23:30	1.245461	0.694285	-1.25	-0.141644	0.041127	0.07827	2.1627	0.168664	0.390373	1.744239	0.663631	0.904888
02/10/2009 23:30	1.488035	0.693378	-1.25	-0.145412	0.045387	0.078059	2.229312	0.107805	4.900271	1.778978	0.658549	0.644274
03/10/2009 23:30	1.298265	0.687345	-1.25	-0.132873	0.049748	0.078033	2.308507	0.093856	6.402234	1.704151	0.664887	0.726684
04/10/2009 23:30	1.233564	0.681715	-1.249999	-0.138706	0.053417	0.07913	2.296236	0.072454	6.724971	1.75565	0.665822	0.759102
05/10/2009 23:30	1.323296	0.70774	-1.249999	-0.142408	0.055531	0.079092	2.307955	0.069752	6.612022	1.806268	0.666043	0.527397
06/10/2009 23:30	1.920722	1.202335	-1.25	-0.142106	0.058728	0.246154	2.784885	1.05547	6.128415	4.178239	0.675907	0.979451

Date & Time	B.LE8 leve	B.LE7 leve	B.LE9 leve	B.LE10 lev	B.LE11 lev	B.LE6 leve	B.LGE6 lev	B.LGE8 lev	B.LGE7 lev	B.LE4 leve	B.LE2 leve	B.LC4 leve
07/10/2009 23:30	1.901959	1.131263	-1.25	-0.140784	0.063232	0.301466	2.527333	0.010932	6.840746	3.087991	0.678324	1.027766
08/10/2009 23:30	1.715277	1.10278	-1.25	-0.141262	0.066956	0.300344	2.129997	0.792907	6.225637	2.345459	0.678963	0.991076
09/10/2009 23:30	1.850625	1.197342	-1.249999	-0.138017	0.054079	0.310247	2.7765	0.944746	7.373322	4.054763	0.682509	1.006497
10/10/2009 23:30	2.110574	1.282623	-1.25	-0.144181	0.055658	0.314918	2.752777	0.990866	7.405879	4.261615	0.68491	1.003304
11/10/2009 23:30	2.438648	1.421542	-1.249999	-0.150951	0.056941	0.316494	2.865705	1.11828	7.525169	4.38667	0.686014	1.01101
12/10/2009 23:30	2.660438	1.271048	-1.249999	-0.144852	0.060912	0.313294	2.22575	0.972672	6.925936	3.306354	0.688293	1.013025
13/10/2009 23:30	2.110887	1.100043	-1.25	-0.149039	0.064547	0.301939	1.495015	0.871008	6.145844	2.245019	0.69575	1.082272
14/10/2009 23:30	1.707252	1.091105	-1.249999	-0.148701	0.066303	0.313449	2.160933	0.894745	7.083234	2.088109	0.696704	0.983103
15/10/2009 23:30	1.237875	1.092308	-1.249999	-0.148181	0.063769	0.309524	2.298862	0.811267	7.152416	2.147835	0.697096	0.916638
16/10/2009 23:30	1.021809	1.110203	-1.249999	-0.147703	0.065481	0.081256	1.894348	0.718125	6.432923	1.700927	0.69172	0.846881
17/10/2009 23:30	1.389626	1.144971	-1.25	-0.149971	0.065472	0.081306	2.235909	0.702074	7.072394	1.457007	0.682589	0.888169
18/10/2009 23:30	1.21744	1.180602	-1.25	-0.1483	0.060171	0.285279	2.390624	0.736963	7.222358	1.684172	0.6753	0.981562
19/10/2009 23:30	1.233477	1.219215	-1.249999	-0.139378	0.062518	0.078631	1.505755	0.655013	6.741897	1.539307	0.67011	0.857334
20/10/2009 23:30	1.115481	-1.25	-1.249999	-0.14354	0.064924	0.081074	2.434966	0.689103	6.900486	1.732008	0.669222	0.761747
21/10/2009 23:30	2.044255	-1.250001	-1.25	-0.145922	0.064003	0.32475	2.946887	1.040253	7.78871	4.488604	0.675651	0.907013
22/10/2009 23:30	2.180487	-1.250001	-1.25	-0.140885	0.063584	0.311688	2.168383	1.003251	6.938353	3.262853	0.676622	0.999823
23/10/2009 23:30	2.454028	1.293394	-1.249998	-0.141155	0.065305	0.320865	2.630908	0.990474	7.441773	2.830085	0.679718	0.981837
24/10/2009 23:30	3.272126	1.540493	-1.25	-0.144991	0.070614	0.329705	2.96839	1.250314	7.818609	4.569059	0.683114	0.994904
25/10/2009 23:30	3.27112	1.626908	-1.249999	-0.141159	0.077543	0.329071	2.825035	1.318233	7.640279	4.310249	0.685766	0.995034
26/10/2009 23:30	3.274485	1.666634	-1.249998	-0.140274	0.081831	0.336709	2.819533	1.358792	7.588012	4.259194	0.687716	0.998004
27/10/2009 23:30	2.88486	1.199375	-1.25	-0.140925	0.025935	0.330516	2.584612	1.259238	7.153434	2.731932	0.686798	0.977177
28/10/2009 23:30	2.780544	1.196021	-1.249999	-0.14074	0.025962	0.335923	2.72849	1.10792	7.541338	2.76003	0.689035	0.940175
29/10/2009 23:30	1.721242	1.147713	-1.25	-0.137036	0.026011	0.325905	1.958844	0.973836	6.996	2.314026	0.687777	0.97863
30/10/2009 23:30	2.371828	1.329232	-1.25	-0.13471	0.026435	0.342768	2.833323	1.143975	7.83869	4.444782	0.692866	1.007089
31/10/2009 23:30	3.136797	1.481505	-1.249999	-0.137094	0.02627	0.34708	2.917585	1.295449	7.865183	4.516165	0.696571	1.009651
01/11/2009 23:30	3.607794	2.267449	-1.249999	0.090237	0.028345	0.370429	3.235589	2.996902	8.0513	4.776634	0.713128	1.05422
02/11/2009 23:30	3.55924	2.279966	-1.249998	0.115556	0.223223	0.368262	3.195162	3.180983	7.957796	4.242017	0.718095	0.98322
03/11/2009 23:30	3.577482	2.232019	-1.249999	0.071172	0.271172	0.374423	3.051404	3.603289	7.708723	4.385965	0.721155	0.924943
04/11/2009 23:30	3.593131	2.299153	-1.249999	0.126261	0.297959	0.348985	2.727263	3.987566	7.477952	4.489517	0.728966	0.97221
05/11/2009 23:30	3.545595	1.832691	-1.25	-0.140561	0.296459	0.323558	2.098403	3.603554	6.877524	2.631168	0.728494	0.977682
06/11/2009 23:30	3.567403	1.744826	-1.25	-0.141334	0.296942	0.330473	2.714597	3.860912	7.310633	4.00613	0.731763	0.931509
07/11/2009 23:30	3.591516	2.090672	-1.25	-0.052872	0.298159	0.350934	3.136763	4.518308	7.872261	4.69601	0.737969	0.947507
08/11/2009 23:30	3.541181	2.178118	-1.249999	0.021546	0.298355	0.34043	2.947476	4.501261	7.657316	4.40973	0.740811	0.942962
09/11/2009 23:30	3.62816	1.946655	-1.249999	-0.139902	0.298297	0.32437	2.626308	4.928414	6.993837	4.956863	0.744839	0.999195
10/11/2009 23:30	3.586098	1.722165	-1.249999	-0.137727	0.298629	0.324754	2.203598	4.617482	6.837079	3.046185	0.747555	0.985501

Date & Time	B.LE8 leve	B.LE7 leve	B.LE9 leve	B.LE10 lev	B.LE11 lev	B.LE6 leve	B.LGE6 lev	B.LGE8 lev	B.LGE7 lev	B.LE4 leve	B.LE2 leve	B.LC4 leve
11/11/2009 23:30	3.610266	1.662018	-1.249998	-0.137389	0.298618	0.342814	3.030079	4.814442	7.83461	4.536678	0.744517	0.980438
12/11/2009 23:30	3.599734	1.730244	-1.249999	-0.136137	0.296622	0.340118	2.810266	4.819328	7.329368	4.16033	0.753811	1.002205
13/11/2009 23:30	3.662957	1.368814	-1.249999	-0.136071	0.29675	0.178002	3.026582	5.102691	6.972726	4.168076	0.756986	0.988333
14/11/2009 23:30	3.614779	2.283002	-1.249999	0.109735	0.297156	0.344797	3.13012	4.965617	7.790799	4.566344	0.764141	1.000322
15/11/2009 23:30	3.600745	2.463389	-1.249998	0.26219	0.297652	0.350187	3.154224	5.050568	7.689417	4.509756	0.76696	1.008009
16/11/2009 23:30	3.613505	3.085724	-1.249999	0.78561	0.743502	0.365507	3.269477	4.976391	7.925705	4.283906	0.774238	0.986916
17/11/2009 23:30	3.617363	2.125848	-1.25	-0.022811	0.295829	0.28733	2.706438	4.941293	6.474904	1.958023	0.774932	0.980855
18/11/2009 23:30	3.624468	1.360718	-1.249999	-0.13532	0.297134	0.315165	2.853816	4.773511	5.879156	1.91557	0.774268	0.980613
19/11/2009 23:30	3.641928	2.331389	-1.249999	0.148428	0.299465	0.361375	3.362376	5.055984	8.048371	4.862502	0.78635	0.989671
20/11/2009 23:30	3.61751	2.481061	-1.25	0.281236	0.300347	0.336508	2.95423	4.808074	7.455846	4.251127	0.789508	1.003576
21/11/2009 23:30	3.631462	3.196344	-1.25	0.881005	0.85224	0.364705	3.297803	5.00645	8.035727	4.715326	0.79564	1.020218
22/11/2009 23:30	3.630582	3.489315	-1.249998	1.122828	1.145766	0.365695	3.298911	5.016538	7.720535	4.788893	0.797607	1.02868
23/11/2009 23:30	3.643376	3.088856	-1.25	0.787658	0.741062	0.358103	2.977669	4.994475	7.437823	2.063493	0.803878	0.977895
24/11/2009 23:30	3.641702	3.728761	-1.25	1.325274	1.380433	0.37142	3.305476	5.055831	7.992799	4.853637	0.809862	0.996407
25/11/2009 23:30	3.654198	2.470816	-1.249999	0.315891	0.302472	0.085125	2.761451	4.919269	7.235877	1.654374	0.81094	0.850613
26/11/2009 23:30	3.679077	1.255712	-1.25	-0.136757	0.296057	0.291744	2.821641	4.568388	7.37693	2.095679	0.807937	0.97902
27/11/2009 23:30	3.584271	1.243024	-1.25	-0.137189	0.256355	0.334804	2.34001	4.56953	6.975292	3.07806	0.809493	0.991022
28/11/2009 23:30	3.604397	1.423902	-1.25	-0.137216	0.258627	0.346782	2.863608	4.860953	7.613503	4.374936	0.811093	0.990132
29/11/2009 23:30	3.618309	1.683601	-1.249999	-0.137624	0.262838	0.34281	2.98944	4.943781	7.576246	4.605607	0.811255	0.999108
30/11/2009 23:30	3.412432	1.201879	-1.25	-0.138468	0.037922	0.318537	1.842674	4.391916	6.765474	2.597267	0.810533	0.980821
01/12/2009 23:30	1.33222	1.163685	-1.25	-0.137589	0.037962	0.340738	2.620542	4.14774	7.472768	2.346108	0.813147	0.977272
02/12/2009 23:30	1.451595	0.704625	-1.249998	-0.135873	0.038209	0.085025	2.260624	3.782565	6.700652	1.855854	0.812846	0.788229
03/12/2009 23:30	1.419933	0.690415	-1.249999	-0.136008	0.037882	0.08462	2.586125	3.101939	7.218068	3.414661	0.806915	0.608073
04/12/2009 23:30	1.359449	0.687817	-1.249998	-0.135461	0.037514	0.085798	2.946062	2.271994	7.695517	4.947756	0.793365	0.70643
05/12/2009 23:30	1.942889	1.329827	-1.249998	-0.136768	0.037421	0.339755	3.120398	3.068001	8.035742	4.67467	0.802564	0.982562
06/12/2009 23:30	2.31857	1.461096	-1.25	-0.138591	0.036039	0.335463	3.088267	3.379351	7.904678	4.55342	0.802946	0.981165
07/12/2009 23:30	1.742967	1.199644	-1.25	-0.138042	0.036595	0.326509	2.42449	3.134698	6.924098	4.051977	0.803433	0.982551
08/12/2009 23:30	1.432269	0.770887	-1.25	-0.135971	0.036902	0.085277	2.421181	1.627612	7.127966	1.698605	0.804515	0.978613
09/12/2009 23:30	1.447498	0.679548	-1.249999	-0.135902	0.036877	0.088301	2.079106	0.601726	6.301405	1.699769	0.802563	0.813371
10/12/2009 23:30	1.003223	0.687656	-1.25	-0.13623	0.036951	0.089615	1.742348	0.01494	6.890232	1.58738	0.799148	0.728751
11/12/2009 23:30	1.164194	0.689882	-1.25	-0.136191	0.036875	0.08854	2.245178	0.016512	6.808542	1.795224	0.793881	0.556711
12/12/2009 23:30	1.202278	0.692054	-1.25	-0.135611	0.037228	0.086107	2.391426	0.017458	7.130743	1.580787	0.789273	0.768837
13/12/2009 23:30	1.192318	0.716767	-1.25	-0.135978	0.037036	0.08625	2.497303	0.012498	7.321839	1.749137	0.784841	0.924567
14/12/2009 23:30	1.154165	0.687819	-1.25	-0.134945	0.036472	0.082278	2.57994	0.55724	6.847952	1.742702	0.772101	0.549648
15/12/2009 23:30	1.103424	0.709263	-1.249999	-0.133417	0.036769	0.083935	2.627725	0.008109	6.902166	1.573914	0.775231	0.338217

Date & Time	B.LE8 leve	B.LE7 leve	B.LE9 leve	B.LE10 lev	B.LE11 lev	B.LE6 leve	B.LGE6 lev	B.LGE8 lev	B.LGE7 lev	B.LE4 leve	B.LE2 leve	B.LC4 leve
16/12/2009 23:30	0.98867	0.725061	-1.249999	-0.132873	0.037067	0.085431	2.675029	0.007226	6.104949	1.769139	0.771229	0.496128
17/12/2009 23:30	1.469424	0.717707	-1.25	-0.136423	0.037536	0.084207	2.621086	0.006935	6.00491	1.780309	0.76556	0.562279
18/12/2009 23:30	1.376035	0.668286	-1.25	-0.133943	0.04585	0.08194	2.587872	0.006686	6.454002	1.734993	0.761083	0.674015
19/12/2009 23:30	1.276563	0.704316	-1.25	-0.132126	0.05058	0.082299	2.665603	0.473086	7.131941	1.806761	0.757513	0.780486
20/12/2009 23:30	1.170344	0.676921	-1.25	-0.131026	0.054106	0.082091	2.731592	0.463969	7.301852	1.737397	0.753226	0.880915
21/12/2009 23:30	1.02604	0.722159	-1.25	-0.136078	0.056239	0.081514	2.812006	0.496856	6.368996	1.802894	0.742997	0.558433
22/12/2009 23:30	1.453453	0.729941	-1.25	-0.133233	0.059752	0.082122	2.792135	0.498578	5.549	1.813762	0.744467	0.586596
23/12/2009 23:30	1.332249	0.690631	-1.25	-0.132299	0.036474	0.081799	2.786504	0.520919	0.280294	1.752589	0.740115	0.50106
24/12/2009 23:30	1.178232	0.670206	-1.25	-0.131484	0.036707	0.081832	2.736406	0.514201	4.874342	1.790852	0.735352	0.602432
25/12/2009 23:30	1.496652	0.706059	-1.249999	-0.133255	0.037624	0.081553	2.708534	0.515513	6.784538	1.796411	0.72314	0.633919
26/12/2009 23:30	1.407857	0.70111	-1.249999	-0.128722	0.038207	0.083378	2.700272	0.551032	6.904022	1.690113	0.727554	0.735945
27/12/2009 23:30	1.342854	0.68493	-1.25	-0.13112	0.036603	0.082499	2.60997	0.592011	6.862095	1.846611	0.722275	0.828614
28/12/2009 23:30	1.211412	0.679058	-1.25	-0.128905	0.037098	0.082698	2.646326	0.574082	6.937614	1.705358	0.718886	0.926966
29/12/2009 23:30	2.021251	1.393341	-1.25	-0.131986	0.036718	0.288631	3.002513	0.926574	7.091749	4.92957	0.717309	0.997717
30/12/2009 23:30	3.340194	1.732405	-1.25	-0.124034	0.038248	0.320887	3.165368	1.318843	7.705398	4.761237	0.72287	0.924673
31/12/2009 23:30	3.445804	1.681514	-1.249999	-0.130725	0.047658	0.31289	3.000179	1.444816	7.511397	4.294528	0.72599	0.934433

APPENDIX 16 PRTR

AER Returns Worksheet

REFERENCE YEAR	2009

1. FACILITY IDENTIFICATION

Parent Company Name	South Tipperary County Council
Facility Name	Donohill Landfill
PRTR Identification Number	W0074
Licence Number	W0074-02

Waste or IPPC Classes of Activity

No.	class_name
3.5	Specially engineered landfill, including placement into lined discrete cells which are capped and isolated from one another and the environment.
3.1	Deposit on, in or under land (including landfill).
3.4	Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.
3.7	##
4.13	Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.
4.3	Recycling or reclamation of metals and metal compounds.
4.4	Recycling or reclamation of other inorganic materials.
4.9	Use of any waste principally as a fuel or other means to generate energy.

Address 1	Garryshane
Address 2	Donohill
Address 3	Co. Tipperary
Address 4	
Country	Ireland
Coordinates of Location	-8.13924 52.5351
River Basin District	IESE
NACE Code	3821
Main Economic Activity	Treatment and disposal of non-hazardous waste
AER Returns Contact Name	Louise Ryan (W0074)
AER Returns Contact Email Address	louisem.ryan@southtippcoco.ie
AER Returns Contact Position	Landfill Manager
AER Returns Contact Telephone Number	062-76277
AER Returns Contact Mobile Phone Number	087-6598692
AER Returns Contact Fax Number	
Production Volume	0.0
Production Volume Units	
Number of Installations	1
Number of Operating Hours in Year	2230
Number of Employees	4
User Feedback/Comments	The method of data entry on the Treatment & Transfer of Waste tab requiring double clicking is number of times is time consuming (eg for EWC codes), this would be much simpler if you could simply type in the data. If you paste an address into the address field in this tab it triggers a bug in the sheet and won't allow you to continue. All the data in this tab was already submitted to the Agency in the Landfill & WMF Survey.
Web Address	www.southtippcoco.ie

2. PRTR CLASS ACTIVITIES

Activity Number	Activity Name
5(d)	Landfills
5(c)	Installations for the disposal of non-hazardous waste
5(d)	Landfills
50.1	General

3. SOLVENTS REGULATIONS (S.I. No. 543 of 2002)

Is it applicable?	No
Have you been granted an exemption ?	No
If applicable which activity class applies (as per Schedule 2 of the regulations) ?	
Is the reduction scheme compliance route being used ?	

4.1 RELEASES TO AIR

SECTION A - SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO AIR

	METHOD			Flare	Diffuse over site		QUANTITY		
	Method Used								
	M/C/E	Method Code	Designation or Description	Emission Point 1	Emission Point 2	Emission Point 3	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
	M	PER	flue gas analyser	1.64	0.0	0.0	1.64	0.0	0.0
	M	PER	flue gas analyser	37.51	0.0	0.0	37.51	0.0	0.0
	C	PER	landgem model	0.0	661351.0	0.0	661351.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B - REMAINING PRTR POLLUTANTS

RELEASES TO AIR

METHOD				QUANTITY			
Method Used							
M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year	
			0.0	0.0	0.0	0.0	

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION C - REMAINING POLLUTANT EMISSIONS (As required in your Licence)

RELEASES TO AIR

METHOD				QUANTITY			
Method Used							
M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year	
			0.0	0.0	0.0	0.0	

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

Additional Data Requested from Landfill operators

For the purposes of the National Inventory on Greenhouse Gases, landfill operators are requested to provide summary data on landfill gas (Methane) flared or utilised on their facilities to accompany the figures for total methane generated. Operators should only report their Net methane (Ch4) emission to the environment under T(total) KG/yr for Section A, Sector specific PRTR pollutants above. Please complete the table below:

Landfill: Donegal Landfill

Please enter summary data on the quantities of methane flared and / or utilised	T (Total) kg/Year	M/C/E	Method Used: Method Code	Method Used: Designation or Description	Facility Total Capacity m3 per hour	
Total estimated methane generation (as per site model)	814154.0	C	PER	Landgem model	N/A	
Methane flared	152803.0	C	PER	Landgem model	6000.0	(Total Flaring Capacity)
Methane utilised in engine/s	0.0				0.0	(Total Utilising Capacity)
Net methane emission (as reported in Section A above)	661351.0	C	PER	Landgem model	N/A	

4.2 RELEASES TO WATERS

Data on ambient monitoring of storm/surface water or groundwater, c

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO WATERS

No	Annex II	Pollutant	M/C/E	Method Used: Method Code	Method Used: Designation or Description
79		Chlorides (as Cl)	M	PER	Lab Analysis
20		Chlorine and inorganic compounds (as HCl)	M	PER	Lab Analysis
83		Fluorides (as total F)	M	PER	Lab Analysis

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO WATERS

No	Annex II	Pollutant	M/C/E	Method Used: Method Code	Method Used: Designation or Description

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION C : REMAINING POLLUTANT EMISSIONS (as required in your Licence)

RELEASES TO WATERS

Pollutant No	Pollutant	M/C/E	Method Used: Method Code	Method Used: Designation or Description
365	Aluminium	M	PER	Lab Analysis
285	Ammonia (as N)	M	PER	Lab Analysis
286	Antimony (as Sb)	M	PER	Lab Analysis
373	Barium	M	PER	Lab Analysis
303	BOD	M	PER	Lab Analysis
374	Boron	M	PER	Lab Analysis
308	Calcium	M	PER	Lab Analysis
358	Cobalt	M	PER	Lab Analysis
309	COD	M	PER	Lab Analysis
320	Magnesium	M	PER	Lab Analysis
288	Molybdenum	M	PER	Lab Analysis
372	Nitrite (as N)	M	PER	Lab Analysis
332	Organophosphate (as PO4)	M	PER	Lab Analysis
336	Potassium	M	PER	Lab Analysis
343	Sulphate	M	PER	Lab Analysis

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

conducted as part of your licence requirements, should NOT be submitted under AER / PRTR Reporting as this only concerns Releases from your facility

			QUANTITY		
SW5 Emission Point 1	Emission Point 2	Emission Point 3	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
6.1	0.0	0.0	6.1	0.0	0.0
0.019	0.0	0.0	0.019	0.0	0.0
0.061	0.0	0.0	0.061	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0

	QUANTITY		
Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
0.0	0.0	0.0	0.0

	QUANTITY		
SW5 Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
0.28	0.28	0.0	0.0
0.36	0.36	0.0	0.0
0.006	0.006	0.0	0.0
0.11	0.11	0.0	0.0
13.51	13.51	0.0	0.0
0.076	0.076	0.0	0.0
0.029	0.029	0.0	0.0
0.015	0.015	0.0	0.0
51.12	51.12	0.0	0.0
19.84	19.84	0.0	0.0
0.015	0.015	0.0	0.0
0.041	0.041	0.0	0.0
0.0085	0.0085	0.0	0.0
16.92	16.92	0.0	0.0
9.49	9.49	0.0	0.0
0.0	0.0	0.0	0.0

4.3 RELEASES TO WASTEWATER OR SEWER

SECTION A : PRTR POLLUTANTS

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER

	QUANTITY		
LC4 (leachate lagoon) Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
5456.0	5456.0	0.0	0.0
1.83	1.83	0.0	0.0
0.198	0.198	0.0	0.0
9690.6	9690.6	0.0	0.0
0.955	0.955	0.0	0.0
2.282	2.282	0.0	0.0
42.16	42.16	0.0	0.0
0.196	0.196	0.0	0.0
1.06	1.06	0.0	0.0
0.669	0.669	0.0	0.0
0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B : REMAINING POLLUTANT EMISSIONS (as required in your Licence)

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER

	QUANTITY		
LC4 (leachate lagoon) Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
4.117	4.117	0.0	0.0
0.586	0.586	0.0	0.0
8.109	8.109	0.0	0.0
3410.0	3410.0	0.0	0.0
39.93	39.93	0.0	0.0
1998.4	1998.4	0.0	0.0
0.55	0.55	0.0	0.0
15059.8	15059.8	0.0	0.0
45.136	45.136	0.0	0.0
1381.36	1381.36	0.0	0.0
17.19	17.19	0.0	0.0
0.61	0.61	0.0	0.0
0.52	0.52	0.0	0.0
12.4	12.4	0.0	0.0
0.0025	0.0025	0.0	0.0
5059.2	5059.2	0.0	0.0
2976.0	2976.0	0.0	0.0
0.806	0.806	0.0	0.0
0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

4.4 RELEASES TO LAND

SECTION A : PRTR POLLUTANTS

RELEASES TO LAND

	QUANTITY	
Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year
	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B : REMAINING POLLUTANT EMISSIONS (as required in your Licence)

RELEASES TO LAND

	QUANTITY	
Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year
	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	Method Used		Location of Treatment	Haz Waste : Name and Licence/Permit No of Next Destination Facility Non Haz Waste: Name and Licence/Permit No of Recover/Disposer	Haz Waste : Address of Next Destination Facility Non Haz Waste: Address of Recover/Disposer	Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY)	Actual Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
						M/C/E	Method Used					
Within the Country	20 03 01	No	195.0	Household Waste	D1	M	Weighed	Onsite in Ireland	Donohill Landfill,W0074-03	Donohill Landfill,Garyshane,Donohill ,No,Ireland		
Within the Country	20 03 01	No	32.0	Dry Recyclables	R3	M	Weighed	Offsite in Ireland	Waller's Lot Waste Transfer Station,W0200-01	Waller's Lot Waste Transfer Station,Cashel,Co. Tipperary,No,Ireland		
Within the Country	20 01 01	No	32.0	Newspapers and Magazines	R3	M	Weighed	Offsite in Ireland	Clonmel Waste Disposal,WP/008-02	Clonmel Waste Disposal,Lawlesstown,Clonmel ,.,Ireland		
Within the Country	15 01 07	No	9.0	Glass packaging	R5	M	Weighed	Offsite in Ireland	Rehab Recycling,08/04 Reg No 635	Rehab Recycling,Rehab building Kylemore Rd. ,Ballyfermot,Dublin 10,Ireland		
Within the Country	15 01 04	No	1.0	Steel packaging	R4	M	Weighed	Offsite in Ireland	Rehab Recycling,08/04 Reg No 635	Rehab Recycling,Rehab building Kylemore Rd. ,Ballyfermot,Dublin 10,Ireland		
Within the Country	20 01 40	No	43.0	Scrap metal	R4	M	Weighed	Offsite in Ireland	Cork Metal,CK(S) 204/05 (M)	Cork Metal,Dublin Hill,Cork ,.,Ireland		
To Other Countries	20 01 11	No	2.0	Textiles	R5	M	Weighed	Abroad	Cookstown Textiles,No	36 magheralane Rd,Randalstown,Co. Antrim,BT41 2NT,United Kingdom		
To Other Countries	16 06 01	Yes	0.06	Batteries	R4	M	Weighed	Abroad	Enva,W0184-01	Enva,Clonminam Industrial Estate,Portlaoise,Co. Laois,Ireland	Campine,047-4955451,Beerse,.,.,.,Belgium	Beerse,.,.,.,Belgium
Within the Country	13 02 08	Yes	1.1	Waste oil	R3	M	Weighed	Offsite in Ireland	Enva,W0184-01	Enva,Clonminam Industrial Estate,Portlaoise,Co. Laois,Ireland	Enva,W0184-01,Clonminam Industrial Estate,Portlaoise,Co. Laois,.,Ireland	Clonminam Industrial Estate,Portlaoise,Co. Laois,.,Ireland
To Other Countries	20 01 27	Yes	1.5	Household hazardous waste	R5	M	Weighed	Abroad	Enva,W0184-01	Enva,Clonminam Industrial Estate,Portlaoise,Co. Laois,Ireland	Geocycle,38.152/BP,Feneffe,.,.,.,Belgium	Geocycle,Feneffe,.,.,.,Belgium
Within the Country	15 01 04	No	0.2	Aluminium packaging	R4	M	Weighed	Offsite in Ireland	Greendragon,CK46/03	Greendragon,.,Cork,.,Ireland		

APPENDIX 17 FINANCIAL STATEMENT

Financial Statement under Section 53 of the Waste Management Act, 1996 (as amended)

Year covered by statement:	2009
Name of Licensee:	South Tipperary County Council
Name of Landfill:	Donohill Landfill
Licence registration No.:	W0074-02
Predicted date of closure:	2013

Detail the financial framework for the acquisition, setting up, development, operation, closure, restoration and aftercare of the landfill.

Acquisition, setting up and development and operation was mostly funded from Annual Revenue.

A loan was taken out for some capping, installation of the flare and development of Cell 4. This loan was for €2.85million and the loan was drawn down in December 2005 and June 2006. the loan was only for part of the cost of these works, the rest was funded from Annual revenue (total cost was €3.6million)

There is No fund set up for the closure, restoration and aftercare of the site.

A loan will possibly be raised for the closure, restoration and aftercare costs, but I cannot say for sure at this stage.

Detail any loans associated with the facility.

A loan was raised for the flare, capping and cell 4 development.

Total value of this loan was €2.85million (20 year loan)

Amount repaid at the start of 2010: €613,908

Annual schedule of repayments: approx. €186,368

Remaining duration (at start of 2010): 16 years

Estimated costs over 30 years for closure, restoration and aftercare of the facility

We haven't calculated the closure, restoration, remediation and aftercare costs.

It is something that we will attempt to calculate.

No fund is currently in place to cover aftercare costs.

Approximately two to three years of active life is left in the landfill

	Income (€)	*Expenditure (€)*
Total income from waste intake this year (excluding landfill levy)	€1,575,994.00	
Amount paid this year to service loans.		€186,368.00
Amount paid this year to contribute to closure, restoration or aftercare costs.		€61,834.49
Nett operational and infrastructure costs this year. *(Not including costs already covered under loans above)*		€1,233,958.60
Income – Expenditure	€93,832	
Balance carried forward from previous years	€0	
Balance carried forward to next year	€0	

Information to be held in confidence?	No

Declaration

I hereby certify that the aggregate of the amount of charges imposed by South Tipperary County Council in respect of the disposal of waste at Donohill Landfill (W0074-02) diring 2009 were not less than the amount that would meet the total following costs (irrespective of whether those costs, or any of them, have been or will be met from other financial measures available to the operator), namely –

- The costs incurred by the operator in the acquisition or development, or both (as the case may be), of the facility,
- The costs of operating the facility during the relevant period (including the costs of making any financial provision under section 53), and
- The estimated costs, during a period of not less than 30 years or such greater period as may be prescribed, of the closure, restoration, remediation or aftercare of the facility.

I further certify that the information given in this form is truthful, accurate and complete.

Signature: Louise Ryan

Print name: LOUISE RYAN

Position: LANDFILL MANAGER

Date: 31-03-10